FOREIGN AGRICULTURE REPORT

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# A STUDY OF THE CITRUS INDUSTRY OF SPAIN 1950



*by*

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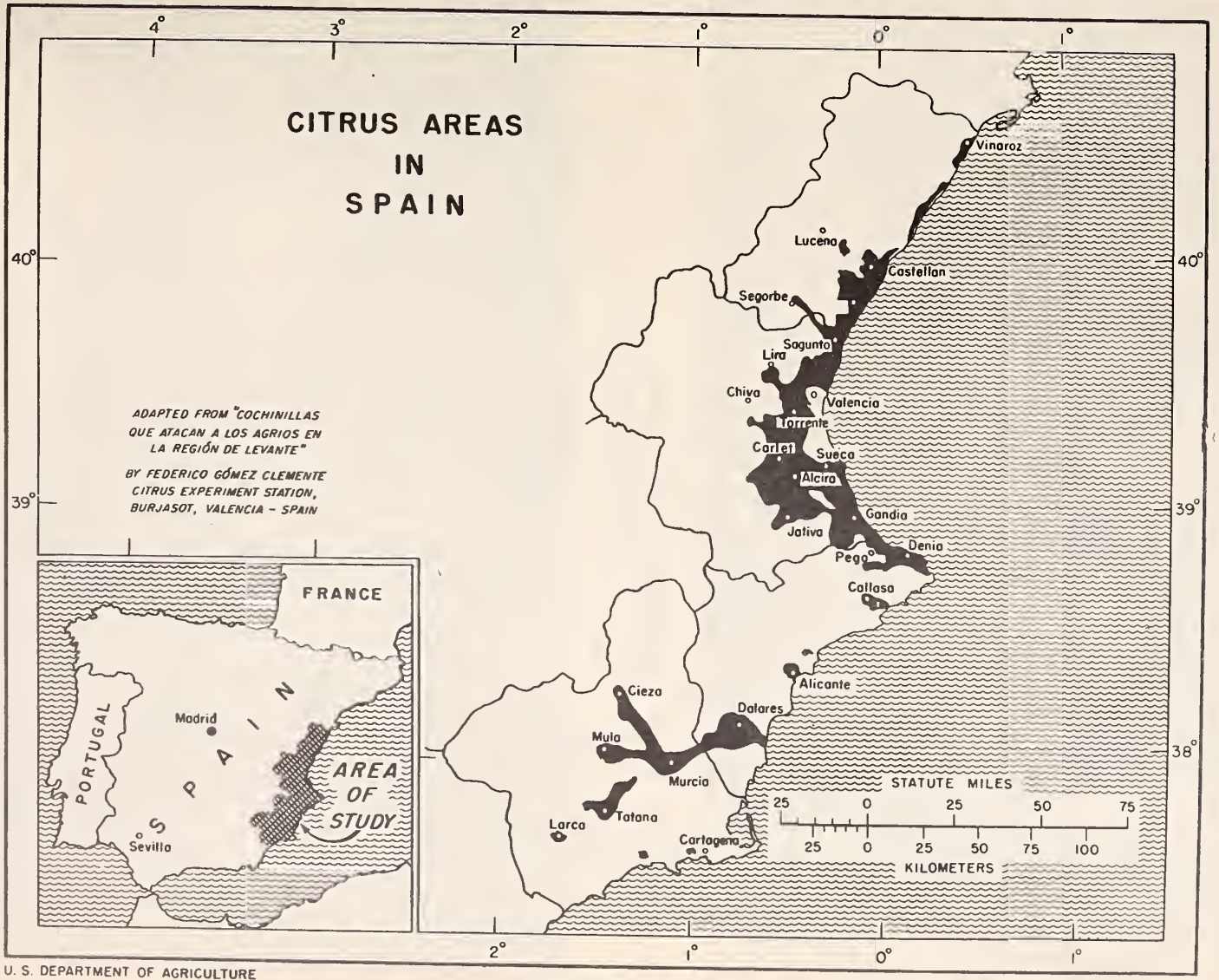


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Figure 1

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C O N T E N T S

Figure 2.--Oranges in a Spanish orchard being counted by the "thousand" --the customary unit of sale.

Figure 3.--Carrying oranges from the grove.

Figure 4.--Loading oranges on a cart for transportation from the grove.

Figure 5.--Packing Spanish oranges for European markets.

Figure 6.--Loading packed sweet oranges aboard ship at a Spanish port.

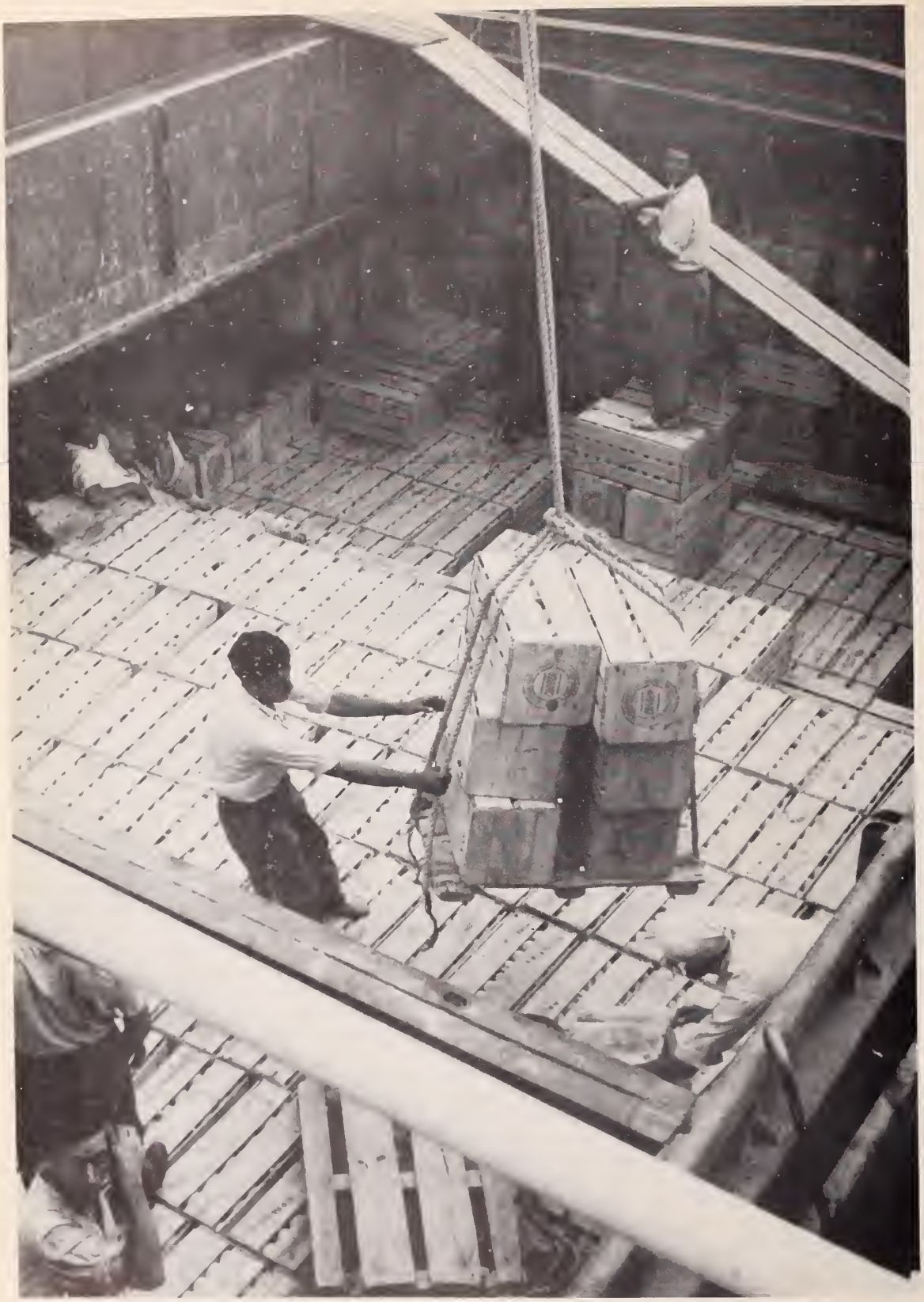


Figure 7.--Stowing Spanish sweet oranges in the hold of a ship.

# FOREWORD

This study of the Spanish citrus industry is the first completed by the Department of Agriculture since Edwin Smith, Marketing Specialist in Fruits and Vegetables, reported on Spain in 1925. Spain is the oldest citrus area supplying the market of western Europe, and it traditionally has been the largest source of oranges for the winter market in western Europe.

This study was made in the interest of the United States citrus industry by the Office of Foreign Agricultural Relations under the provisions of the Research and Marketing Act as a part of the program to develop and maintain foreign markets for agricultural commodities. By understanding the factors in a foreign producing area such as Spain, the United States citrus industry may better evaluate present and future competition in the international market.

The possibilities of broadening and maintaining foreign markets for other agricultural commodities also are being studied by this Office, and the findings are presented in other circulars and reports that may be obtained, free, from the Office of Foreign Agricultural Relations, United States Department of Agriculture, Washington 25, D. C.

Joseph A. Becker

Joseph A. Becker, Chief
International Commodities Branch

# A C K N O W L E D G M E N T

This study is the result of the work of many persons both in Washington and in the field. In Spain valuable assistance was rendered by the foreign service officers at Valencia, Seville, and at the American Embassy in Madrid. These officers made available not only valuable information but also necessary clerical assistance and transportation to citrus producing areas.

All of the information dealing with the scientific study of the various aspects of the Spanish citrus industry was obtained through the citrus experiment station at Burjasot near Valencia. Translated excerpts from the scientific work of this experiment station have been utilized in the report to illustrate various aspects of the Spanish citrus industry and the author wishes to express appreciation to the Spanish Ministry of Agriculture and particularly to Manuel Herrero de Egana, director of the experiment station, and his competent staff.

Spanish citrus growers and processors were generous with their time in taking the author through their groves and processing plants. They were truly hospitable in the Spanish tradition.

The statistical data in this report were compiled by Ruth Tucker with the assistance of Marguerite Golden and Christine Hudson.

Spanish source material has been used quite extensively, particularly as regard to scientific subjects. This was made possible through the excellent translations of Spanish documents by May Coult.

The scope and content of this report have been developed under the guidance of Gustave Burmeister, Head of the Fruit, Vegetable & Sugar Division of the Office. The report has profited greatly from his counsel.

# THE CITRUS INDUSTRY OF SPAIN

by

J. Henry Burke
Marketing Specialist

For this Spanish citrus study, the author made two visits in 1949. The first was for two days in March, during which time a motor trip was made through the citrus area which lies between Valencia and Castellon. A longer visit was made between June 13 and July 20. The more important citrus areas were studied quite intensively during this time, and a motor trip was made from Valencia to Castellon and into the back country of Castellon, where irrigation dams were observed. Orchards in the vicinity of Nules, Burreana, and Sagunto were visited. Out of Valencia, a small citrus area near Chiva, Torrente, and Carlet was observed.

Southward along the coast, the low-lying areas near Suca, Gandia, Denia, Villajoyosa, and Alicante were visited. Farther south, the citrus areas near Orihuela and Murcia were seen, and representative lemon orchards and packing houses in the Murcia district were visited. Returining to Valencia from Murcia, the author drove through some of the interior country, leaving the coast road near Elche and driving through Monforte, Agost, Jijona, Alcoy, Onteniente, Jativa, and Alcira. Citrus plantings of the Ribera were seen as far south as Jativa, the more important being in the vicinity of Carcagente. In the vicinity of Valencia, visits were made to the important processing plants. The bitter orange district was visited from Seville, and inspections were made of representative orchards and processing plants in the vicinity of that city.

The travel in Spain is recorded here in some detail with the thought that it may help the reader in evaluating this report.

## SUMMARY

The Spanish citrus industry is one of the oldest commercial citrus industries in the world and has supplied western Europe with citrus fruits since the seventeenth century.

Production: In the season of 1949-50 Spain produced 22,126,000 boxes of sweet and bitter oranges, 945,000 boxes of tangerines, and 870,000 boxes of lemons. The production of all citrus in Spain has been declining for the last 15 years, and the present production of oranges is approximately half that of 1930. The production of tangerines has also declined recently, primarily due to the damage to groves by frost in 1946. The production of lemons has declined, and today's production is only about half what it was 15 years ago.

Spanish citrus acreage: According to official statistics there were approximately 198,871 acres of citrus in Spain in 1945-46. This would be an

increase of nearly 20,000 acres since 1930. Observations of citrus areas do not confirm this acreage figure, however. Considering these observations and the yield of citrus per acre in 1949, the total Spanish citrus acreage, including sweet and bitter oranges, tangerines, and lemons, should not be estimated to exceed more than 90,000 acres for all commercial plantings. An additional 20,000 acres may be considered to exist but not in condition for commercial production.

Spanish sweet orange districts: Spanish sweet orange districts are located along the southern coast of Spain. North of Valencia near the coast is the region of La Plana, including Sagento and Castellon. In these districts tangerines are grown to a large extent. South of Valencia and near the seacoast is the district of Marina, which lies near Gandia. It is an excellent producing district near the seacoast and quite free from frost. Inland from the Marina and on higher ground lies what is probably the best sweet orange district in Spain in what is known as the Ribera. In the Ribera all irrigation water is pumped, and citrus is grown on light soils on elevated ground. The trees grow to large size and make exceptional yields of fruit.

The district of Murcia: Still farther south along the coastline lies the district of Murcia which is important primarily for its production of lemons.

Climate: The climate of the citrus districts of Spain is similar to that of California. The zones of the La Plana are subject to frequent frost damage. The zone of the Marina, being near the seacoast, has a very small frost hazard and a more humid climate. The zone of the Ribera, while subject to frost damage at times, has a climate more favorable to citrus.

In the coastal district of Spain, rainfall averages from 10 to 15 inches per year, and the rain falls primarily in the fall and spring months. However, there is some sporadic precipitation during the summer. The climate in the bitter orange district of Seville is very different from that of the coastal zone; rainfall is approximately 32 inches per year, and summer temperatures are much higher than those in the coastal zone. The summers are more arid, with no rain at all for approximately 3 months, and the humidity is generally much lower than in the southern coastal zone.

Frost is a very great hazard in Spanish citrus areas, and in the 25 years since 1925 frost or hail damage has reduced crops in 10 separate years. There was extensive tree damage because of frost in 1926-27 and again in 1934-35 and in 1946-47.

Spanish citrus soils: There is considerable difference between Spanish citrus soils. Near the Ribera the heavier soils lie on the low ground, while the lighter more sandy soils are on the elevated portions of the districts.

Spanish citrus varieties: Spanish orange varieties are very different from those known to United States producers. The most important group are the so-called blond or white oranges, which consist of the seeded comuna and the seedless cadenera. These are both non-blood oranges of approximately the same season as the navel. They are excellent quality fruits and have

good processing qualities. The Washington navel is also raised in Spain. Following the season of the navel is the season of the fine blood oval oranges, the best of which, according to Spanish standards, is the doble-fina. The late variety orange is a non-blood called the verna or berna, which is an oval-shaped orange harvested after April. It is considered by some Spanish growers to have shipping qualities superior to those of the Valencia late, which is also grown to a very minor extent.

The most important lemon variety grown in Spain is one called the verna or berna, the same name applied to the late orange. This Spanish lemon, which is grown primarily in the vicinity of Murcia, has the characteristic of producing summer fruit.

In order to present data to help the reader gain an understanding of the nature and quality of Spanish oranges, a tabulation of weight changes of seven Spanish orange varieties, by months, is presented in Table 9, as well as an analysis of the juice characteristics of nine varieties and a Spanish study of the carotinoid pigment contained in different Spanish citrus fruits. Also included is a comparison of seasonal changes in seven Spanish orange varieties as to physical and chemical characteristics of the fruit.

Cultural practices: Spain is an old citrus area, and the citrus culture is well established. From observations it is apparent that the general quality of citrus culture is excellent.

Cultivation: Spanish citrus orchards are cultivated almost entirely by hand.

Disease control: Root fungus diseases are controlled by basins built around the tree to keep irrigation waters away from the trunk.

Many outbreaks of psorosis were observed in all citrus areas of Spain, primarily on Washington navel varieties. Very little orchard treatment is given this disease.

Nurseries and nursery trees: There are few commercial nurseries in Spain, the majority of the young citrus trees being raised on the farm by growers. There is apparently no method by which nursery stock may be registered free from psorosis.

Spanish citrus pests: Spain has the majority of the common citrus scales which have spread gradually through citrus orchards. The importance of each type of scale varies with the district in accordance with the temperature and humidity in the local area.

Pest control: From observations, the pest control measures seem to be generally excellent. Scales are controlled primarily by fumigation. During the Spanish Civil War years citrus pests were permitted to increase because of the lack of labor and pest control materials. Since pesticides have again become available, fumigators state that the dosages of gas which previously gave excellent results will not accomplish effective control today.

Oil sprays are also used as an auxiliary pest control measure, particularly when sodium cyanide is not available for fumigation.

Irrigation: In Spanish citrus districts, irrigation is accomplished by the use of both gravity and pumped water. Some of the systems of gravity irrigation were established by the Moors at least 400 years ago.

Fertilization: Since the Spanish Civil War, fertilizers have been in short supply, and they are still rationed to growers by the Government. In the 1948-49 season the Government allotment of sulphate of ammonia in the Castellon area was approximately 125 pounds per acre. The Government allotments of chemical fertilizers are sold at official prices; however, additional quantities may be had at black market prices.

Chemical fertilizers are still in short supply in Spain and are likely to remain so due to the shortage of foreign exchange.

Frost protection: There is no frost protection practiced in Spanish citrus groves, in spite of the high frost hazards. In groves in the vicinity of Castellon it was observed that some growers utilize skyrockets to attempt to break up clouds which might precipitate damaging hail on citrus groves.

The Spanish Department of Agriculture: An experiment station is operated at Burjosot near Valencia. Crypt for the control of mealy is raised there. It is a rather small operation for commercial purposes; however, so far as the author knows, it is the only place where crypt is raised, and supplies are even sent from Valencia to North Africa.

In addition to studies and scientific investigations on various cultural problems in Spain, extensive experimentation on processing problems is being conducted. Some of the scientific work being carried on at this station is of very excellent quality.

Domestic consumption: The domestic consumption of citrus in Spain has changed in the last 20 years. Prior to the Civil War, there was a much smaller domestic consumption of fruit. However, since the war brought Spaniards in contact with citrus fruit, the consumption has increased. Also, the recent World War tended to increase domestic consumption, since these markets were sought by growers when it was no longer impossible to export fruit.

Picking: In Spain citrus fruits are picked by men, women, and children, and the fruit is usually clipped from the tree; however, picking bags are not used, and the fruit receives very hard treatment in being transported from the groves to the packing houses.

Packing: Rather modern-type packing houses are being established in Spain. While many of the processes, such as box making, are still carried on by hand, most of the larger packing houses have washers, graders, and sizers.

Transportation: Transportation from citrus groves to the packing houses is still primarily by the two-wheel springless cart. It is a very efficient vehicle; however, it makes for rough handling of fruit. Transportation between the packing house and shipping port may be either by motor truck or by narrow

gauge railroads which serve most citrus areas.

Freight rates: Freight rates for Spanish citrus fruits both by rail and sea may be considered more reasonable than those paid by the North African citrus grower.

Cost of Packing: In 1949 it may be estimated that the cost of packing a 66-pound box of oranges was approximately $1.24, converting the peseta at 16.45 pesetas to the dollar.

Export marketing: In the 1948-49 season Spain exported 10,982,760 boxes of sweet oranges, 423,063 boxes of bitter oranges. In 1948, 484,693 boxes of lemons were exported.

Spain sells her citrus fruits by means of trade agreements. All sales are made under careful controls of currency, so there is little relationship between the selling price and the cost of production.

Economic factors: Spanish citrus groves are very small, the average less than 2 acres in size. Most of the properties are operated by the owner, and only a very small percentage of groves are rented.

Wages are controlled by the Government, and in 1949 at Castellon ordinary orchard labor was paid approximately $1.52 per day, converting the peseta at 16.45 pesetas to the dollar.

Most Spanish farm workers either have access to land where they can grow crops by sharecropping, or have a small piece of land where they raise a portion of their foodstuffs. Therefore, only part of their real earnings are in terms of wages.

Cost of Production: The record of yeilds of 46 Spanish groves indicates that the general level of production is excellent. A yield of 300 boxes to the acre is not uncommon in the better districts, and the majority of Spanish commercial citrus groves in 1949 produced between 246 and 394 boxes per acre, on the average.

The cost of operating a citrus grove in 1949 may be estimated to range between $279.88 to $326.91 per acre.

The cost of production of oranges in Spain in 1949 may be estimated to range between $.78 and $1.07 per box converting the peseta at 16.45 pesetas to the dollar.

The break-even cost f.o.b. Spanish ports on a 66-pound, 2-compartment box of packed fruit may be estimated to range all the way from $.84 to $4.13, depending entirely upon the exchange rate used. Since the official basic dollar exchange rate is 10.95 pesetas to the dollar, and the free rate is approximately 40 pesetas to the dollar, the cost of production in terms of dollar conversion means very little.

Processing: The citrus processing industry may be divided roughly into two types of plants. There has been a processing industry for many years, and

one company has been selling processed citrus juices since 1913. However, many of these small old plants prepare a product which is preserved with the addition of sulphur dioxide.

In addition to these old plants, there are three major processing plants located in the vicinity of Valencia, and one of these has been constructed within the past 2 years. Two of these plants are capable of producing a pasteurized juice, and one of them has concentrating apparatus and sells 65 brix concentrate to the British Ministry of Food. This plant has a capacity of at least 250,000 gallons of orange juice concentrate a year. One of the plants has a concentrating process in which cold is used in concentrating the juices.

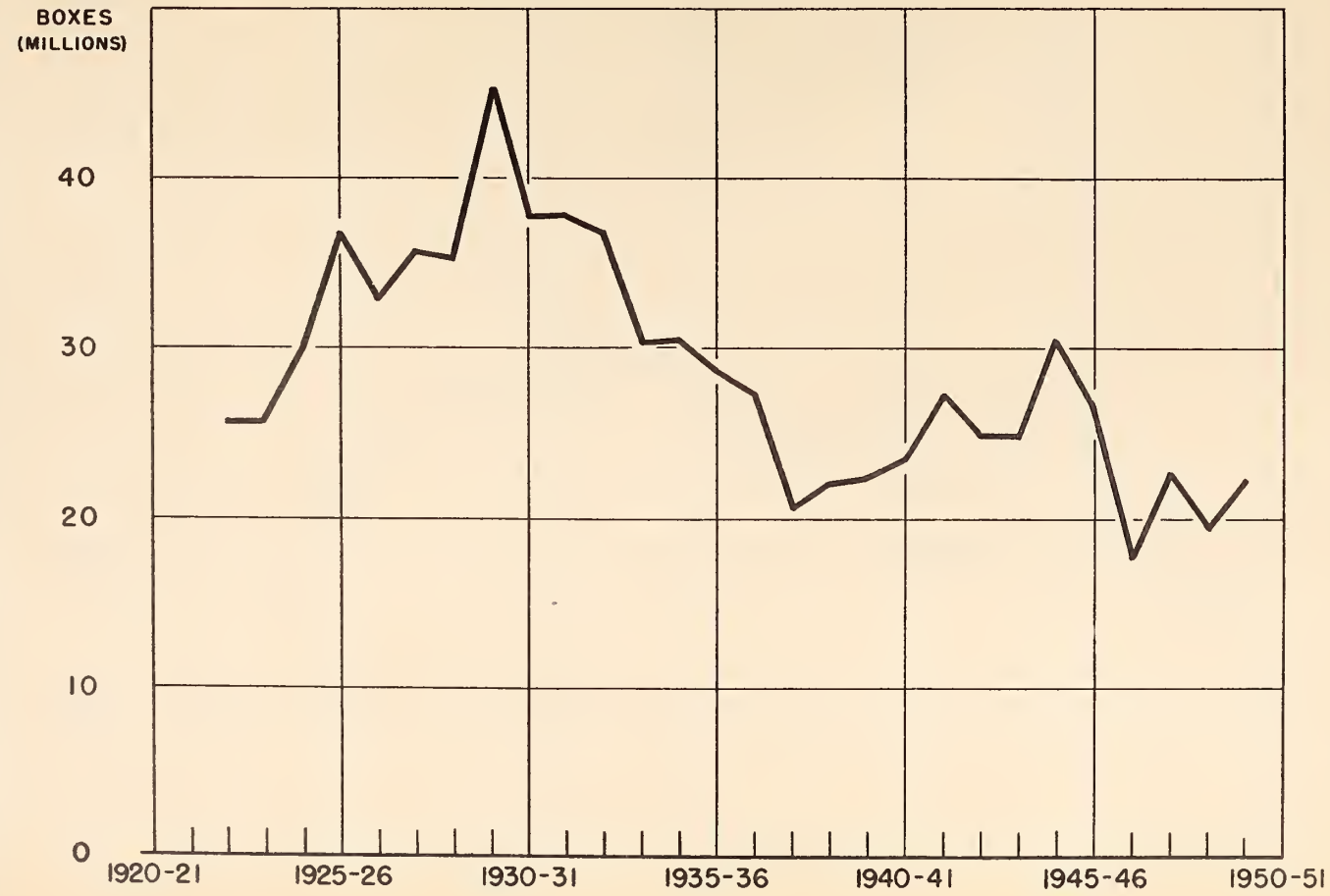
In addition to fruit products, there is also an industry of essential oils, pulp, and peel.

Conclusions: Due to the reduction of acreage, production of citrus from Spanish orchards may not be expected to exceed 23,620,000 boxes annually in the next 5 years.

Due to the shortage of electric power and the rather poor transportation facilities, the Spanish processing industry may not be expected to expand much beyond its present extent.

Spain may be expected to continue to be highly competitive in international trade in fresh citrus fruit.

# SPAIN: SWEET AND BITTER ORANGE PRODUCTION
## 1922-23 — 1949-50

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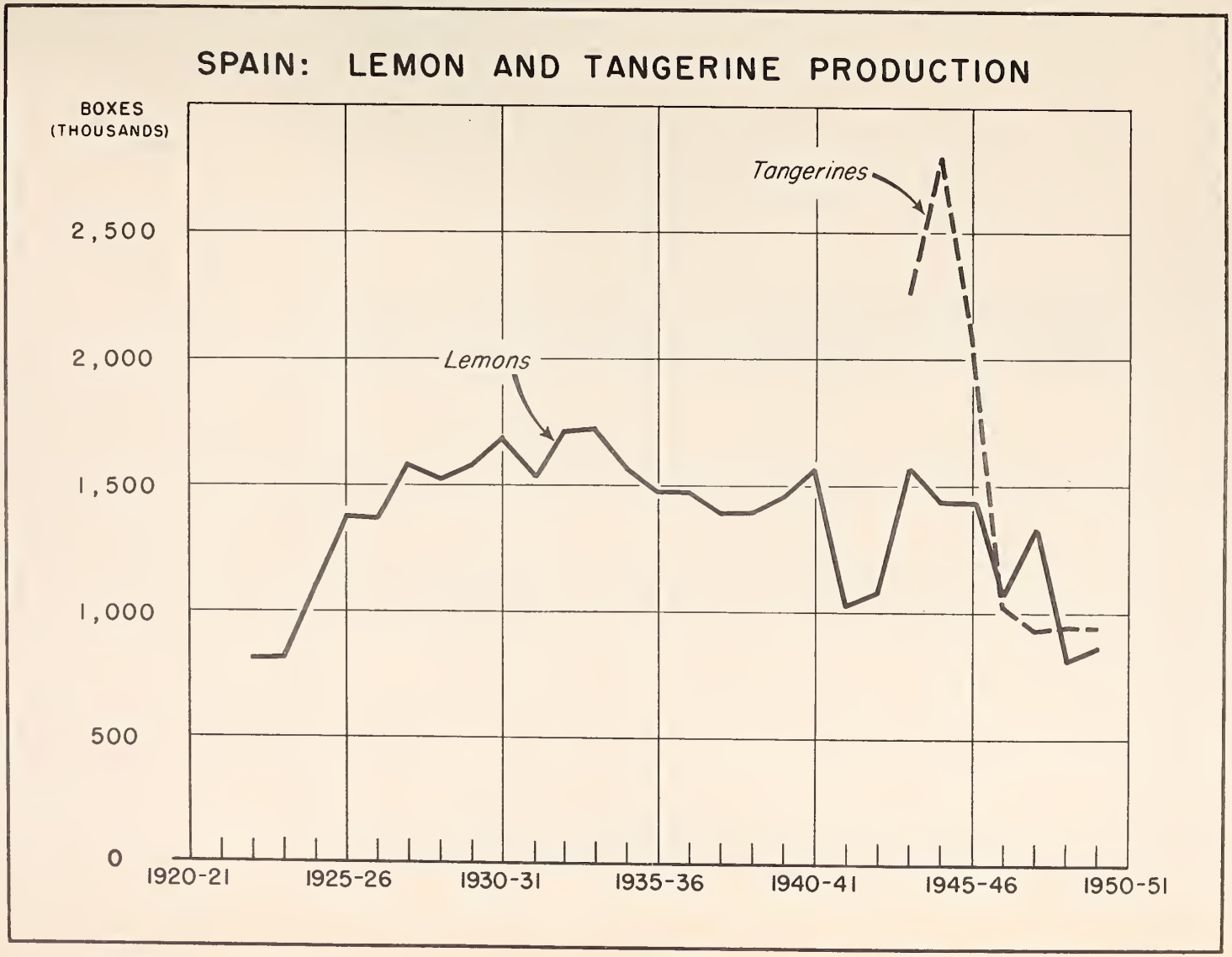


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Table 1.--Spain: Citrus production by kinds, 1921-49

| Years | Sweet and bitter oranges | Tangerines | Lemons |
|---|---|---|---|
| | 1,000 boxes | 1,000 boxes | 1,000 boxes |
| 1921-22 | --- | --- | --- |
| 1922-23 | 25,756 | --- | 816 |
| 1923-24 | 25,745 | --- | 816 |
| 1924-25 | 30,000 | --- | 1,100 |
| 1925-26 | 36,896 | --- | 1,377 |
| 1926-27 | 32,884 | --- | 1,368 |
| 1927-28 | 35,749 | --- | 1,587 |
| 1928-29 | 35,276 | --- | 1,524 |
| 1929-30 | 45,205 | --- | 1,586 |
| 1930-31 | 37,676 | --- | 1,699 |
| 1931-32 | 37,929 | --- | 1,538 |
| 1932-33 | 36,881 | --- | 1,714 |
| 1933-34 | 30,461 | --- | 1,724 |
| 1934-35 | 30.541 | --- | 1,582 |
| 1935-36 | 28,654 | --- | 1,481 |
| 1936-37 | 27,191 | --- | 1,479 |
| 1937-38 | 20,686 | --- | 1,400 |
| 1938-39 | 22,046 | --- | 1,400 |
| 1939-40 | 22,266 | --- | 1,463 |
| 1940-41 | 23,514 | --- | 1,577 |
| 1941-42 | 27,334 | --- | 1,029 |
| 1942-43 | 24,921 | --- | 1,085 |
| 1943-44 | 24,901 | 2,265 | 1,573 |
| 1944-45 | 30,576 | 2,803 | 1,431 |
| 1945-46 | 26,603 | 2,060 | 1,438 |
| 1946-47 | 17,772 | 1,029 | 1,083 |
| 1947-48 | 22,801 | 932 | 1,339 |
| 1948-49 | 19,558 | 945 | 812 |
| 1949-50 | 22,126 | 945 | 870 |

## HISTORICAL BACKGROUND

The Spanish citrus industry is one of the oldest commercial citrus industries in the world. Citrus entered international trade in Europe at a very early date. Flemish and Dutch paintings of about 1600 often show citrus fruits in still life studies. In these studies oranges, tangerines, and lemons are seen, and it is likely that the oranges were primarily of the bitter variety.

Citrus was grown very early on the southern coast near Valencia and also in the vicinity of Seville. It is very probable that part of the citrus fruits entering Europe in the 1600's came from Spain. The Spanish fruit syndicate, in a booklet on the Spanish citrus industry, provides some very interesting observations on the early Spanish citrus, and a translation of some of these observations is given below. 1/

The sweet orange was known to the orientals, for Vasco de Gama, who in 1948 was the first to go around the Cape of Good Hope, says in the account of his voyage that there were a great many orange trees in India, but they all had sweet fruit.

The first agronomic study of the orange tree was made in Spain by Gabriel Alonso de Herrera in his "Book of Agriculture," written in 1513, in which he refers principally to the transformation of the bitter orange into sweet.

Other descriptions of the Spanish orange groves were given by various travelers who traveled through or lived in Spain during the 16th, 17th, and 18th centuries. The account by Micer Andrea Navagero, ambassador of Venice to Charles V, is outstanding. Such descriptions are basically, and sometimes exclusively, of the orange groves of Andalucia, especially those of Seville and Granada.

The first who speaks concretely of the existence of sweet oranges on La Plana is the druggist of Castellon, don Jose Gimenez, who refers to them in an unpublished treatise on plants, in the year 1713.

Cabanilles, royal commissioner for the study of plants in Spain, issued a written report in 1797, in which he speaks of orange groves in Gandia, Carcagente, and Villarreal. The irrigated land of Villarreal is conspicuous for producing oranges, and he says that 500,000 arrobas of fruit of all classes were gathered there, the majority of which were oranges.

In Burriana the orchard of Mascaros was bought, when the cultivation of the orange had not yet become general, for 11 pesetas and a hog. It was turned into an orange grove and divided, and the price of 10,000 pesetas was obtained for one part of this grove.

It is stated that, in the province of Castellon, Villarreal was the first town that began to produce oranges in any considerable quantity, near the end of the 18th century. Orange farms were organized formally between 1825 and 1830, during which period intensive cultivation was being extended, on the basis of orchards planted exclusively to orange trees, to other towns in the province.

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1/ Source: Sindicato de Frutos. Agrios de Espana (Fruit Syndicate. Citrus Fruits of Spain), May 1948.

The city of Burriana is among those which occupy first rank, being perhaps the most active and outstanding in the orange export trade in modern times.

## CITRUS ACREAGE IN SPAIN

Table 2.--Spain: Citrus acreage and tree plantings, by years, 1931-46 1/

| Years | Area in production | | Total Number of trees |
|---|---|---|---|
| | Hectares | Acres | |
| 1931-32 | 72.476 | 179,088 | 25.777.384 |
| 1932-33 | 74.638 | 184,430 | 26.361.317 |
| 1933-34 | 77.146 | 190,628 | 29.630.509 |
| 1934-35 | 75.096 | 185,562 | 28.986.890 |
| 1935-36 | 76.793 | 189,756 | 29.308.345 |
| Between the quinquennium 1931-32-35 and 36 | 75.230 | 185,893 | 28.012.889 |
| 1939-40 | 78.148 | 193,104 | 30.021.704 |
| 1940-41 | 77.675 | 191,935 | 29.861.154 |
| 1941-42 | 78.187 | 193,200 | 30.278.252 |
| 1942-43 | 81.700 | 201,881 | 31.018.566 |
| 1943-44 | 81.159 | 200,544 | 31.070.357 |
| Between the quinquennium 1939-40-43 and 44 | 79.374 | 196,133 | 30.450.007 |
| 1944-45 | 81.095 | 200,386 | 31.032.004 |
| 1945-46 | 80.482 | 198,871 | 30.816.892 |

1/ La Riqueza Citricola Espanola, by Luis Roson Perez, page 308 (Includes lemon and orange acreage).

It is interesting to compare the official statistics on acreage in table 2 with circumstances which have influenced the citrus industry in Spain. The official statistics show a constant growth in both acreage and trees, which statement is difficult to reconcile with other facts.

In January 1935, there were severe hail storms in the vicinity of Castellon and frosts in early January and again in late January with temperatures as low as 4 and 5 degrees centigrade. Records of that time indicate that a minimum of 30 percent and as much as 40 percent of the season's crop was lost due to frost and that 80 percent of the fruit on the trees at the time of the frost was lost. In March 1935 the Ministry of Agriculture estimated that 1,200,000 trees would have to be removed due to frost damage. At the same time the trade estimated that 1/2 million to 800,000 trees would have to be replaced.

It was also stated that during this period there was a great deal of activity in top-working older citrus varieties, such as the Comuna, to the Washington navel, and that as much as 7,500 acres were being rebudded at that time. That severe damage to trees is not indicated in official statistics.

The crop of 1935-36 was reduced considerably due to frost damage. At that time the political situation in Spain was unsettled in the beginning of what was to be the Civil War. The 1936-37 crop was grown during the period of civil turmoil in Spain, and comments from reports at the time indicate that labor was not available to cultivate, irrigate, or fumigate trees, and therefore there was much damage and the fruit produced was of a low quality. That crop is estimated as "rather small." In 1938, while accurate figures are not available, another freeze occurred in January, further decreasing the amount of fruit produced.

Unfavorable weather and frost occurred in January 1939, and, in January 1941, a severe frost occurred, destroying according to statements at that time, 50 percent of the crop. At that time, due to lack of pest control materials, damage by scale was prevalent. In January 1946 another severe freeze took place, doing damage primarily in the region of La Plana, which includes Castellon. This freeze was of such a severe nature, occurring with 16 to 18 inches of snow on the ground, that many groves had to be cut back to the trunk, and it is estimated that, in the region of La Plana, 20 percent of the acreage had to be removed. Observations bear out an acreage reduction.

These occurrences are mentioned in some detail in order that it may be understood that today's Spanish citrus production is down because of an extensive reduction in acreage which has occurred over the past 15 years.

Sweet Orange and Tangerine Acreage

This reduction in acreage can be further illustrated by analyzing the sweet orange crop of 1948-49. It is estimated that 54 percent of Spanish sweet orange production is in the vicinity of Valencia, including the Ribera, and that 46 percent represents the plantings of La Plana and the several other small citrus districts. The Ribera, with its large trees, generally produces more heavily than La Plana and other citrus regions. From attached tables, which give actual production figures from representative groves, it will be noted that groves in the Valencia area produce from 150 to 400 arrobas of 12½ kilos each per hanegada (299 to 800 boxes per acre), while the majority of groves in the region of La Plana, Sagunto, and Castellon produce generally better than 100 arrobas to the hanegada (200 boxes per acre) and in many cases 200 arrobas per hanegada (400 boxes per acre). One may calculate acreage by taking the estimate of 1948-49 production of 650,000 tons and dividing it in accordance with the acreage percentage figures indicated above and considering that 54 percent of the production was from acreage which produced 2,400 kilos (200 arrobas) per hanegada and 46 percent from acreage which produced only 1,200 kilos (approximately 100 arrobas) per hanegada or approximately 200 boxes per acre. The Valencia share of the production, 54 percent, at the rate of 200 arrobas per hanegada (400 boxes per acre) could be produced on 146,300 hanegadas (29,260 acres) and that the balance of the production, 46 percent, would require 249,160 hanegadas (49,832 acres) at a production of 100 arrobas per hanegada

or approximately 200 boxes per acre. These are moderate production estimates which inspection of the groves indicates are reasonable and conservative, and we may therefore consider that the commercial producing sweet orange and tangerine acreage in Spain in 1949 was approximately 395,460 hanegadas (79,092 acres).

This acreage figure is less than one-half that credited by official statistics for total citrus acreage in Spain. Since sweet oranges and tangerines comprise approximately 90 percent of Spanish citrus acreage the total commercial producing citrus acreage of Spain may be considered at approximately one-half that credited by official statistics.

In 1949 the total Spanish citrus acreage, including sweet and bitter oranges, tangerines, and lemons, should be estimated not to exceed 90,000 acres for all commercial plantings. An additional 20,000 acres may be considered to exist but not in condition for commercial production since the trees either have been neglected or cut back severely due to recent frost damage. In these non-commercial orchards row crops are usually being raised among the remaining orange tree stumps.

The reasons for this discrepancy in acreage may be various. First, it is interesting to note that the abbreviation of hectare is Ha and that of hanegada ha. In compiling statistics it might be easy to confuse the two and, since the hanegada is only 1/12 of a hectare, confusion would lead to considerable discrepancy in statistics. Also, fertilizer has been very scarce for many years and it has been allocated on the basis of registered acreage. It would be far easier to obtain fertilizer for an exportable crop such as citrus than for annual crops. Therefore, it has been a general practice for growers not to change their registration of groves when trees are removed, in order to maintain their right to a fertilizer ration.

Table 3.--Spain: Citrus acreage in the most important producing provinces by indicated kinds, 1946 1/

| Province | Oranges | | Tangerines | | Lemons | |
|---|---|---|---|---|---|---|
| | Hectares | Acres | Hectares | Acres | Hectares | Acres |
| Alicante | 5,234 | 12,933 | ---------- | ---------- | 494 | 1,221 |
| Almeria | 1,715 | 4,238 | ---------- | ---------- | 28 | 69 |
| Badajoz | 149 | 368 | ---------- | ---------- | ---------- | ---------- |
| Baleares | 395 | 976 | 100 | 247 | 50 | 124 |
| Barcelona | 48 | 119 | ---------- | ---------- | 32 | 79 |
| Caceres | 111 | 274 | ---------- | ---------- | ---------- | ---------- |
| Cadiz | 325 | 803 | ---------- | ---------- | 13 | 32 |
| Castellon | 17,928 | 44,300 | 3,290 | 8,129 | 36 | 89 |
| Cordoba | 370 | 914 | ---------- | ---------- | ---------- | ---------- |
| Granada | 128 | 316 | ---------- | ---------- | 9 | 22 |
| Huelva | 391 | 966 | ---------- | ---------- | 17 | 42 |
| Malaga | 1,557 | 3,848 | ---------- | ---------- | 965 | 2,385 |
| Murcia | 4,557 | 11,260 | 208 | 514 | 1,717 | 4,243 |
| Sevilla | 1,406 | 3,474 | 12 | 30 | 24 | 59 |
| Tarragona | 516 | 1,275 | 48 | 119 | 3 | 7 |
| Valencia | 38,360 | 94,788 | 3,494 | 8,634 | 332 | 820 |
| Totals | 73,190 | 180,852 | 7,152 | 17,673 | 3,720 | 9,192 |

1/ These acreages show the comparative importance of citrus districts. The commercial acreage is probably about half of acreage shown.

Source: La Riqueza Citricola Espanola by Luis Roson Perez, page 299.

# SPANISH CITRUS DISTRICTS

## Spanish Sweet Orange Districts

The Spanish sweet orange area extends along the coast from Castellon in the north to a point approximately 10 kilometers north of Denia. This area may be roughly divided into three districts, La Marina, the Alta and Baja Ribera, and La Plana.

The district of the Marina lies south of Valencia along the coast, with plantings beginning at the coastal foot of the mountain range which divides the southern Valencia plain. Large citrus plantings begin along the foot of this mountain range immediately above the large rice plantations. Plantings continue southward in a narrow strip along the foot of the mountain slopes, increasing to extensive solid plantings in the valley Gandia and Pego. Some of the older trees are somewhat larger than in the region of La Plana, and trees are not so heavily pruned. This area produces larger crops than the La Plana, and its small groves, which average 3 to 7 hanegadas (2/3 to 1-1/3 acres) are relatively free from frost.

The La Plana region extends north of Valencia, the largest plantings being north of Sagunto. These plantings are on a low, relatively level coastal plain, with some plantings extending inland along valley floors. In this area trees are generally small and heavily pruned, and this is one of the coldest commercial citrus districts in the world.

The district of the Ribera also lies south of Valencia in a large valley on the inland side of a mountain range which separates it from the coast and the Marina district. Going north from Gandia the traveler turns inland at Favrita and follows the road from Monasterio to Alcira. The area of the Ribera is in the large valley west and north of Alcira. In the upper valley toward Carcagente and Jativa are to be found some of the best sweet orange plantings in Spain with large, vigorous trees well cared for. Pruning is relatively less severe than in the La Plana, and the area is relatively free from frost.

## Citrus Culture in the Marina

Citrus culture in the Marina is similar to that of the Baja Ribera, and the small orchards are given excellent care. Groves are small, some 3 to 7 hanegadas, and trees are planted close together, as many as 200 to the acre. In the lower regions of the Marina, irrigation water may easily be pumped from the high water table by means of simple animal-powered water wheels. Water from the higher plantings is obtained either from wells drilled in the property or from reservoirs supplied with water elevated from the lower plain by pumps. In areas adjacent to water courses some gravity water is available for irrigation. From observations in July of the amount of water in the river at Gandia, it is evident that there are still considerable undeveloped water resources in the region.

Along the foot of the hills those groves which are lowest and nearest to the sea are surrounded by windbreaks of either cane or cypress. The Marina is characterized by small, well-kept groves in a practically solid-planted district in the vicinity of Gandia and Pego.

Cultivation is done primarily by hand, with animals being used in a few of the larger properties.

In this area the cost of operation of a hanegada on the average is approximately 750 pesetas ($230.64 per acre), and one man can usually take care of 20 hanegadas (approximately 4 acres), doing all work, cultivation, irrigation, pruning, and so forth.

An Intermediate District

In the marshes within 10 kilometers of Valencia is a very large rice producing area. However, in the vicinity of Sueca there is a belt of orange plantings which follows both banks of the Jucar River. This citrus area is bordered on both sides with plantings of rice. A little farther south and toward the mountains is the district of Corbora, which is reported to raise the sweetest oranges in Spain.

Citrus Plantings North of Valencia (La Plana)

North from Valencia, the first major citrus plantings are found about 5 kilometers south of Sagunto. In this area there is a belt of planting extending from the highway to the vicinity of the coast. All plantings occur within a distance of 5 miles from the coast but the area planted is a solid belt of trees paralleling the seashore. Beyond Sagunto a very extensive area is found from Benitairo de les Valls and Almenara on to Nules. Plantings are primarily oranges. However, there is considerable acreage of tangerines and minor plantings of lemons. The next large citrus area is in the vicinity of Castellon and plantings there extend in and up the valley for a distance of approximately 8 kilometers from the sea.

It is general practice in the La Plana citrus area to prune trees extensively, keeping them low (few are higher than 12 feet), and to open up the centers of each tree so that the bearing surface is rather like an inverted cone. The skirts of the tree are also pruned rather high so that after fruit has been removed the first bearing limbs appear at a height of 3 to 4 feet. While this heavy pruning is general practice, some orchards observed in the vicinity of Almenara had apparently been left unpruned and had a bearing surface similar to that common in United States orchards. This produces a somewhat larger tree, the largest of them being approximately 18 feet in height.

Various plans of planting were observed. Some orchards were planted at nearly normal American distances, 90 to 100 trees per acre. However, general practice is to plant more heavily, and orchards containing 200 trees to the acre are quite common.

Unpruned walnut and apricot trees adjacent to citrus areas in the coastal belt grow vigorously to good size, which would seem to indicate that larger trees would result if citrus were left unpruned and fewer trees planted to the acre. Upon inquiry as to why vigorous pruning was carried on, the concensus among Spanish growers was that the tops of unpruned trees do not produce fruit, and, since most fruit is produced on the lower third of the tree, the top is a useless appendage.

The great majority of trees observed were over 20 years of age, and trees 30 or 40 years old were quite common. Some new plantings were seen, but, from observation, one would estimate that the new plantings approximately equal the areas of the old groves being removed. There is, therefore, an approximate balance in the present acreage.

The trees in this area are in various conditions. Those which have had ample fertilizer show a heavier population of dark green leaves. Those groves which do not have sufficient fertilizer have a low leaf population, and one can see through the tree quite easily. In the area north of Sagunto severe damage to trees was suffered by frost in 1946, and the evidence of this damage may still be seen. Much deadwood from this frost damage is still present on larger limbs in most groves. From appearances, it would seem that after the frost damage many trees were cut back to stumps 4 or 5 feet from the ground and that the entire top is now built on new growth since 1946. It is not the practice to paint or seal large cuts, and therefore unhealed ends of dead limbs are formed by this type of culture. The most severe frost damage was observed in the vicinity of Castellon.

It would seem unlikely that trees rebuilt on old stumps would ever produce crops equal to those of 15 years ago, regardless of the amount of fertilizer which might become available.

The tendency of growers seems to be to doctor an old tree rather than to remove it and replant. Many severely damaged trees have not been removed, and there is considerable citrus acreage on which crops are being raised between the trees. Plantings of Irish potatoes, sweet potatoes, beans, and even hay were observed.

Only flood irrigation was seen in the entire area. Borders or ridges down the row middles control the water. Under that system the entire surface of the orchard is wet except where trees are suffering from root disease, in which case a basin is placed around the base of the tree, the lower roots are exposed, and an attempt is made to keep the water away from the tree. Considerable mottle and other signs of malnutrition were seen.

The Ribera

Some of the finest citrus groves in Spain are to be found in the vicinity of Carcagente in what is known as the Alta Ribera. Citrus plantings are found on rolling ground on the slopes of the foothills. In this district there are great differences in soil conditions. The lower groves (Baja Ribera) have a heavy loam soil and are irrigated by gravity water, whereas the higher plantings

have a light sandy soil and are irrigated by pumped water entirely. The largest trees, quite similar in size to those found in California, are growing there, and they produce large quantities of fruit of high quality. The types of planting are similar to those in Riverside, California, and the soil is similar to the sandy loams of Orange County, California. Groves in this area are very different from those north of Valencia in La Plana. The trees of the Ribera are three to four times as large, are not pruned as severely, and are similar in appearance to the trees of California orchards.

It is reported that the price of land in this area may be as much as twice that in the vicinity of Castellon. Good citrus land in the Ribera may cost as much as 20,000 pesetas per hanegada ($6,150.37 per acre). In the Ribera the trees are larger than in the southern districts, and, while pruning is still an extensive practice, it is not as heavy as that of the La Plana. Since no tree damage was experienced in the frost of 1946 in this area the trees are in generally good condition, and the color of the leaves indicates at least reasonable quantities of fertilizer have been used. The soil is red and flood irrigation is practiced. Cultivation is primarily by hand. 2/ Fumigation is the method of pest control when cyanide is available.

The production of fruit per hanegada may be estimated at approximately twice that of the southern area, and in normal years 300 to 400 arrobas of 13 kilos each may be produced on a hanegada (621 to 828 boxes per acre). In this area there are only a few tangerines, primary production being white oranges, with some more recent plantings of navels, blood ovals, vernas, and Valencia lates. This is one of the oldest citrus areas in Spain, and while there are still many of the old type packing houses which contain little machinery, there are a number of installations which contain fruit washers, driers, graders, and packing tables similar to installations in United States packing houses. Most packing machinery utilized in Spain is manufactured locally.

All of the important plantings of citrus in Spain occur below the altitude of 200 feet.

Windbreaks are not the general practice in Spain but, in the citrus plantings of the Baja Ribera which are near the rice fields or on the edge of citrus district facing the sea winds, clipped hedges of citrus or fences of cane are used as windbreaks.

In the lower Ribera irrigation water is obtained from the coastal water table. It is often pumped by horse-operated pumps. There are also irrigation systems in which water is obtained from the lower water table and pumped to reservoirs from which irrigation is accomplished by gravity. While there are some dams which impound water for irrigation, the amount of water flowing in rivers indicates that there are still untouched water resources available when additional dam construction can be accomplished.

As in all Spanish citrus areas, water distribution in this area is handled through the square, open, concrete or street ditch, which is always raised above

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2/ Usual planting distances are 25 "palmas" or hand reaches, or approximately 16 to 18 feet.

the ground level. The ditches appear much as fences lining the groves.

## Murcia

In the vicinity of Murcia is located the primary lemon producing area in Spain. There are some lemons scattered through the other citrus areas, a few trees located in Villajoyosa. However, the majority of heavy plantings are within 50 kilometers of Murcia.

Plantings consist of three varieties, the Real, verna, and Primaflore. Of these the verna is by far the most important.

Plantings are from Orijuela to Murcia, and primary acreage is located in two river valleys between Murcia and Cieza, and between Murcia and Mula where citrus is produced at an elevation of 200 meters, or approximately 600 feet.

The Murcia region is more barren than that of the northern country. The dry hills have little or no vegetation and are quite a contrast to the green valley floors where irrigation water is available.

The soil is unlike that of the northern regions and is a gray type with sufficient clay in it to crack as it dries. Water penetration is slow, the soil remaining damp for some considerable time after irrigation. The soil is slick and muddy for several days following the application of water.

As in other parts of Spain, land holdings are generally small, and, while a considerable acreage is planted to solid orchards of lemons, it is quite common to see mixed orchards. Plantings of olives and lemons, apricots and lemons, lemons and peaches, lemons and small vegetables, and lemons and potatoes are common.

The trees are similar in appearance to those in commercial Californian orchards and generally seem in quite healthy condition.

Growers irrigate by flooding the entire surface, as is the case in other Spanish citrus districts. Fruit from the trees is picked three or four times a year, the time and frequency of picking depending upon the sale of fruit.

The fruit is clip-picked from the tree and carried to the packing house in baskets where it is piled on the floor approximately 4 feet deep. The fruit is then sorted and wrapped by hand, the wrapper being held by each end and given a twirl. One packing plant estimated that 15 women with one man supervisor would wrap approximately 5,000 kilos per 8-hour day, or approximately 333 kilos (slightly less than 700 pounds) per wrapper. Fruit is usually shipped in 30-kilo cases, and the 300 count is a popular size. Larger fruit is shipped more to the Baltic and Scandinavian countries than to continental Europe and England, which prefer a smaller fruit. Some fruit is shipped in bulk, and in June 1949 a small shipment was being so prepared. After wrapping, the fruit was placed in baskets in which it would be carried to the port of Cartagena for shipment to an Italian port where it would be transferred to rail cars

for bulk shipment into Switzerland. In that season the price of lemons to France was 1.92 pesetas to 2.10 pesetas ($.12 to $.13) at the frontier. Sales are primarily under trade agreements, sale of lemons to Switzerland being under a combined account whereby the Swiss subsidize exports to Spain. In sales to France, a credit is open of 1.50 pesetas per kilo ($.04 per pound), and the amount received over and above that is for a combined account.

Packers estimate that the cost of a 30-kilo wooden case is approximately 6.75 to 7.75 pesetas ($.41 to $.47) at Murcia. They further estimate that the cost of packing a 30-kilo case of ordinary lemon varieties, including the cost of the box, is 27 pesetas ($1.64), and the cost of packing the Verdelli lemon is 37 pesetas ($2.25).

The land unit at Murcia is not the hanegada but the tajulla, which consists of 1,118 square meters compared to the 832 square meters of the hanegada. Normal planting distances at Murcia are 40 trees per tajulla for lemons and 46 trees for oranges. The production of lemons in normal times is estimated at approximately 3,000 kilos per tajulla and can be increased to 5,000 kilos when adequate fertilizer is available. The production may be estimated another way as being 10 arrobas per tree. In Murcia an arroba is 11-1/2 kilos; therefore, normal plantings would give a production of 4,600 kilos per tajulla. At the current price of at least 1-1/2 pesetas per kilo on the tree during the 1949 season, the average return may be estimated at 6,900 pesetas per tajulla. The cost of production would not seem to be more than 1,500 pesetas per tajulla. Therefore, at these prices a very substantial profit has been realized.

The tax basis for operation varies with the province in Spain. In the Murcia area there is a government land tax of approximately 50 pesetas per tajulla, plus a provincial tax of 12-1/2 centavos per arroba of production, in addition to which the fruit buyer pays a city tax of from 1 to 2 percent of the value of the fruit handled.

The lemon acreage in Murcia is not being extended but is being reduced since other crops produce a more assured income. At prices indicated above a substantial profit is indicated. It should be kept in mind, however, that the Spanish lemon meets with severe competition in the market, and conditions are frequently such that the full crop is not harvested and there is considerable loss of fruit in the grove. It was observed that some orchards were being removed, and areas were pointed out where lemon orchards had been removed. The fruit fly does not bother lemons. However, scale pests present a production problem. Murcia has a disadvantage which is not present in other Spanish industries in that it is located some distance from the port. It costs approximately 75 centavos ($.05) per 30 kilo case to transport fruit from Murcia to Cartagena. As in other citrus areas, cultivation is accomplished by hand. From observations it would seem likely that the production of lemons in Spain would not exceed present levels and may be reduced in subsequent years.

It is a Spanish practice to leave lemons on trees until they color or at least begin to break in color. In the Murcia district lemons grow to a large size before beginning to break in color. This is a severe handicap to the industry since a large percentage of the fruit produced is oversized. In Spanish retail markets, even in Madrid, quantities of these large lemons are observed for sale.

However, it is fortunate that the Spanish market, probably because it is accustomed to this size fruit, pays a fair price for the large lemon. The large fruit is primarily a handicap in export trade.

Because of the large size of Spanish lemons in normal years, nearly one-half of the crop is usually exported to Scandinavia, primarily to Denmark, and Sweden, and some supplies were also sent to Switzerland, Belgium, and France. No cold storage facilities exist in the lemon producing areas, and the food is shipped immediately after being picked.

## CLIMATE

The citrus districts of Spain are climatically similar to those of California. The southern coastal districts in which the sweet oranges are raised differ climatically from the bitter orange producing section near Seville.

The sweet orange producing districts extend along the southern coast of Spain from somewhat north of Castellon to south of Murcia. In this area are found important climatic differences. The districts north of Valencia, including Castellon, are on a relatively level coastal plain which is more subject to frost damage than are the more southern areas. This level district is called La Plana. The second citrus district is Marina, which lies south of Valencia in the vicinity of Gandia. It lies near the coast on somewhat sloping ground with mountains immediately in back of it. There is usually good cold air drainage there, and the district is usually well protected from frost. The third district lies inland from the Marina and is located on high, usually sloping ground near Alciria. This is probably the finest citrus district in Spain and is called the Ribera. Because of the terrain it is not so subject to frost as is the plain of Castellon. The southernmost district in which lemons are an important crop is near Murcia. It is some distance from the sea, and because of frost hazards lemons are usually planted on slopes which lead off the valley floor. The region of Murcia has lower humidity than the other northern citrus districts.

The bitter orange section near Seville is inland from the sea and has a more violent climate than the southern area, being less humid and having temperatures at least 10 degrees warmer in summer time. It also has a rainfall double that of the coastal area.

Table 4.--Spain: Rainfall by months, 1947

| Month | Castellon | Valencia | Murcia | Seville |
|---|---|---|---|---|
| | Inches | Inches | Inches | Inches |
| January | 1.0 | .4 | 1.9 | 3.9 |
| February | 2.8 | 1.8 | .6 | 12.5 |
| March | .09 | 1.0 | .3 | 6.8 |
| April | .07 | .02 | .04 | .4 |
| May | 2.5 | 1.3 | 2.0 | .4 |
| June | .1 | 0.0 | .03 | 0.0 |
| July | .6 | .07 | .04 | 0.0 |
| August | 1.7 | 3.4 | 1.3 | 0.0 |
| September | 1.5 | 2.0 | 1.2 | 1.0 |
| October | 2.5 | 2.8 | 4.3 | 2.5 |
| November | .7 | .03 | .09 | 2.7 |
| December | .3 | .04 | .9 | 1.8 |
| Total | 13.9 | 12.9 | 12.7 | 32.0 |

Table 5.--Spain: Minimum and maximum temperatures by month for 1947

| Month | Castellon | | Valencia | | Murcia | | Seville | |
|---|---|---|---|---|---|---|---|---|
| | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum |
| | F. | F. | F. | F. | F. | F. | F. | F. |
| January | 29.0 | 74.0 | 32.0 | 55.0 | 28.0 | 68.0 | 28.0 | 69.0 |
| February | 35.6 | 76.0 | 25.0 | 73.4 | 30.0 | 76.0 | 37.4 | 65.0 |
| March | 38.0 | 78.0 | 40.5 | 75.0 | 36.0 | 75.5 | 42.8 | 86.0 |
| April | 44.0 | 82.0 | 40.0 | 79.0 | 32.4 | 80.0 | 40.5 | 90.0 |
| May | 48.0 | 85.0 | 49.0 | 80.0 | 41.0 | 81.0 | 37.0 | 94.0 |
| June | 58.0 | 94.0 | 55.0 | 95.0 | 45.0 | 88.0 | 54.0 | 102.0 |
| July | 69.0 | 92.0 | 64.0 | 94.0 | 61.0 | 93.2 | 58.0 | 112.0 |
| August | 65.0 | 101.0 | 63.0 | 98.0 | 63.0 | 78.0 | 59.5 | 107.6 |
| September | 54.6 | 85.0 | 52.0 | 89.0 | 64.0 | 72.0 | 49.0 | 98.0 |
| October | 53.0 | 81.0 | 50.0 | 82.0 | 51.0 | 84.0 | 50.5 | 89.0 |
| November | 38.0 | 87.0 | 38.0 | 83.0 | 31.0 | 85.0 | 32.5 | 81.5 |
| December | 36.0 | 72.0 | 32.5 | 76.0 | 31.0 | 71.0 | 31.6 | 65.5 |

Source: Anuario Estadistico de Espana, 1948.

Rainfall in Spanish citrus areas is erratic, particularly so in recent years. The normal season of rainfall is similar to that of California, extending from September to April. The normal rainfall is approximately 12 inches per year in most districts. The summer is usually dry except for occasional thunder showers. The rainfall at Seville is at least double that of the coastal area, but it occurs at approximately the same time of year. The summers are much dryer and there is no precipitation in the middle of the summer.

In the southern coastal region hail can cause severe damage even in July. No hail damage was seen near Valencia in 1949, but a few miles away a hail-storm had completely defoliated an area of grape production. Some citrus growers seek to protect their orchards against hail by attempting to break up clouds which might produce hail storms. They do this by firing rockets into the clouds sometimes as much as 2,000 feet into the air. The rockets are approximately 2-1/2 inches in diameter and about 3 feet long, with wooden fins and aluminum tips.

Wind storms occasionally damage citrus crops in all Spanish citrus areas, but particularly in those most exposed to the sea; the citrus groves in the Marino district near the seacoast are protected by windbreaks. When wind storms cause an excessive drop of ripe fruit, this fruit is harvested and utilized for processing purposes. As in other Mediterranean citrus areas, the hot desert winds from the Sahara occasionally do damage to both fruit and trees.

Because of the greater frost hazard in the La Plana region, early varieties are raised there in order that the fruit may be harvested before January frosts. The danger of frost damage in Spain is exceedingly great, and some of the sweet orange districts must certainly be among the coldest commercial citrus producing areas. Below is given a record of frost damage for approximately 25 years: 3/

| Crop Year | Comment |
|---|---|
| 1925-26 | Severe frost in late December caused a 35 percent loss of total crop. |
| 1926-27 | A great frost occurred December 24 to 27, destroying 30 percent of the citrus crop, snow and frost doing extensive tree damage. |
| 1927-28 | In December hail damaged the Ribera. |
| 1930-31 | Frost in January destroyed 10 to 25 percent of crop. |
| 1931-32 | Frost and hail destroyed an estimated 10 percent of crop. |
| 1934-35 | Two freezes occurred in January. These, together with hail storms, destroyed an estimated 500,000 citrus trees, according to the Spanish Department of Agriculture. |
| 1935-36 | Crop reduced because of tree damage preceding year. |
| 1939-40 | Cold weather slightly damaged citrus crop. |
| 1940-41 | Freeze destroyed an estimated 40 to 50 percent of orange crop. |
| 1942-43 | Cold weather in January and February is reported to have reduced crop. Frost damage in January destroyed 50 percent of unharvested fruit. Minimum temperatures in some districts reported to be 8 degrees Centigrade, approximately 17-1/2 Fahrenheit. |
| 1946-47 | Severe freeze in January 1946, extending from the 16th to the 18th, with minimum temperatures in some districts of 8 degrees Centigrade, approximately 17-1/2 degrees Fahrenheit and a temperature in Valencia of 19.40 Fahrenheit, did severe damage. This was the most devastating freeze Spain has experienced in recent years, occurring with over a foot of snow on the ground. Many trees even 20 years of age were killed to the snow-line by the frost; 60 percent of the crop was lost. |
| 1947-48 | Small citrus crop due to extensive tree damage by frost preceding year. |
| 1948-49 | Trees in the La Plana not yet recovered from frost damage. |

3/ From reports of the American Consuls at Valencia.

Spanish citrus growers claim that one reason for the superior quality of their fruit is that it is raised near the climatic limit for citrus. This rigorous climate gives the fruit its beautiful color and fine flavor. From the above it will be seen that the climatic hazard in Spanish citrus districts is exceedingly great.

## SPANISH CITRUS SOILS 4/

The quality of soils in which citrus is raised in Spain varies greatly from one region to another, and in some areas it varies widely in short distances. South of Valencia in the district of Carcagente, Alcira is an excellent example of this. Alcira is one of the more important sweet orange districts near Valencia. In this district the soils vary greatly, from the heavy type on the low ground near the coast to the light sandy gravel soil on the higher elevations. Because of this difference in the character of the soil there is a great difference in the quality of fruit produced. The quality of fruit grown on the low heavy soils may be quite different and much poorer in quality than that of fruit of the same variety raised nearby on high light sandy soils. Because of the importance of this citrus district and the difference in soils which it contains, a study has been made by the Orange Experiment Station at Burjasot near Valencia. The findings of this study were published in June 1948 as publication 48 of the Experiment Station. The following are some of the observations made which are quite representative of the soil conditions in Spanish citrus districts.

The area studied includes approximately 3,436 hectares of citrus, 8,490 acres, and is quite typical of the better Spanish citrus districts. The fruit raised is primarily oranges, and the distribution by varieties is indicated in the following tabulation:

| | |
|---|---|
| Comuna (non-blood seeded) | 47.088 percent |
| Navel | 26.250 percent |
| Sangre (blood) | 11.202 percent |
| Verna | 3.365 percent |
| Mandarina (tangerine) | 6.270 percent |
| Cadenera (non-blood seedless) | 5.119 percent |
| Otras (others) | 0.456 percent |
| Limonero (lemons) | 0.250 percent |
| Total | 100.000 percent |

As in most Spanish citrus districts, the average orange groves are very small, and the distribution of this citrus acreage is indicated in table 6.

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4/ Source: Spanish study of citrus soils in the vicinity of Alcira by Manuel Herrero de Egana. This is a paraphase of some of the material in this publication as well as a translation of some parts of this article. Translated from the Spanish by Evelyn M. Loveless.

Table 6.--Spain: Distribution of orange groves in different size groups in the Alcira sweet orange district

| Hanegadas | Acres | Number of groves | Percentage |
|---|---|---|---|
| 1 | .20 | 78 | 1.64 |
| 1 to 2 | .20 to .40 | 498 | 10.48 |
| 2 to 5 | .40 to 1 | 2,069 | 43.58 |
| 5 to 10 | 1 to 2 | 1,199 | 25.25 |
| 10 to 20 | 2 to 4 | 559 | 11.78 |
| 20 to 50 | 4 to 10 | 264 | 5.57 |
| 50 to 100 | 10 to 20 | 65 | 1.37 |
| 100 to 200 | 20 to 40 | 11 | .23 |
| 200 and over | 40 and over | 5 | .10 |
| Total | | 4,748 | 100.00 |

The object of the study was to correlate the different qualities of soils with the qualities of the oranges which each soil produced. In carrying out the analysis of the soils in the district, 600 samples were used in the test, and the pH value of these citrus soils varied between 6 and 8 pH value. The results of the text, indicated by grouping the soils according to the scale developed by Kopecky, are shown in table 7.

The citrus soils of Alcira may be classified into three types, a heavy loam, a sandy soil, and a very sandy soil. The chemical composition determined by tests clarified the differences between these types. Three types are clearly shown on the table, which indicates the rating of the soils by the test according to the scale of Kopecky. It will be noted that the three types of soils are indicated on the table as being grouped first into those of scale 9 Kopecky, second 10 Kopecky, and third 16 of Kopecky. It is interesting to note that from this study the superior types of citrus soils of Carcagente are identical to the superior citrus soils of Alcira. Because of this correlation it is intended to carry on these soils studies in other citrus producing areas of Spain in order that a better understanding may be developed of the correlation between the qualities of soils and the quality of fruit produced. By such an analysis it may also be possible to suit each variety of citrus to the soil which will develop the best commercial production for that particular variety.

Continuing to classify the three types of soils in this region, we may summarize as follows:

Type A: Soils in this classification fall in the Kopecky scale No. 8, 9, 10, and 11, a mechanical analysis. All are alluvial soils situated in low lying ground. They contain a high percentage of loam and clay and are distinctly of a heavy type for oranges. They are usually quite close to a water table and are irrigated by gravity water as are 25.5 percent of the groves in this district.

Table 7.--Spain: Results of mechanical soil testing in Alcira, Kopecky method

| Entry | Number of samples in each group, groups (Kopecky) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Alborchi | | | | | | 1 | 6 | 1 | | | | | 2 | | |
| Alfanella | | | | | 1 | 4 | | | | | | | | | |
| Almunia | | | | | | 2 | 1 | 7 | | | | | | | |
| Barralbet | | | | | | 3 | | 7 | | | | | | | |
| Barraques: | | | | | | | | | | | | | | | |
| Plantaes | | | | | | | | | | | | | 7 | | |
| Azagador | | | | | | | | | | | | | 3 | | |
| Solana | | | | | | | 3 | | | 1 | | | 2 | | |
| Fondo | | | | | | | 5 | 1 | | 1 | | | 5 | | |
| Benirrabea | | | | | 1 | 1 | 2 | 1 | | | | | | | |
| Berca | | | | | | 3 | 4 | | | | | | | | |
| Cabanes | | | | | | | 2 | 2 | | | | | | | |
| Cano | | | | | | | 7 | 1 | | 1 | | 1 | 2 | | |
| Cantal Gros | | | | | | | 2 | | | | | | 3 | | |
| Canada | | | | | | | | 4 | 1 | | | | 1 | | |
| Casella | | | | | | | 1 | | | | | 8 | 12 | | 1 |
| Cementerio | | | | | | | 2 | | | 1 | | 7 | 12 | | |
| Conv.º Aquas Vivas | | | | | | | | | | | | | 1 | | |
| Enquenencia | | | | | | 2 | 2 | | | 2 | | | | | |
| Fraca | | | | | | | | | 1 | 1 | 7 | 11 | 7 | 1 | 4 |
| Jijara | | | | | | | 7 | 1 | | 3 | | | 2 | | |
| La Coma | | | | | | | 8 | | | 4 | 1 | 2 | 7 | | |
| Les Bases | | | | | | 1 | 5 | | | | | 1 | 1 | 1 | 1 |
| Masaseli | | | | | | 4 | 2 | 4 | | | | | | | |
| Maranent | | | | | | 1 | 3 | 1 | | 1 | | | | | |
| Masroig | | | | | | 3 | | 1 | | | | | | | |
| Materna | | | | | | | | 1 | | 1 | | | 2 | 1 | |
| Mulata | | 1 | | | 1 | 4 | 4 | 1 | | | | | | | |
| Pla | | | | | | 5 | 2 | 3 | | | | | | | |
| Pla de Corbera | | | | | | | 30 | | 1 | 2 | | 2 | 14 | | |
| Pla de la Murta | | | | | | 1 | 9 | | 1 | 1 | | 2 | 26 | | 1 |
| Prada | | | | | | | | 1 | | | | | | | |
| Rafol | | | | | | 3 | 3 | 5 | | | | | | | |
| Rec-Nou | | | | | | 6 | | 2 | | | | | | | |
| Rumbau | | | | | | 1 | 2 | 2 | | | | | 2 | | |
| San Bernabe | | | | | | | 8 | 1 | 1 | 5 | | 4 | 7 | | |
| San Bernardo | | | | | | 5 | 4 | 7 | | | | | | | |
| Serradal | | | | | | 4 | 3 | 2 | | | | | | | |
| Tisneres | | | | | | | 8 | | 1 | 1 | | | 24 | 4 | |
| Tolls | | | | | | | 7 | 1 | | | | | | | |
| Tora | | | | | | 1 | 2 | 11 | | | | | | | |
| Toro | | | | | | 2 | 3 | 3 | | | | | | | |
| Torrecho | | | | | | | 2 | 1 | | | | | 5 | | |
| Tubell | | | | | | | 6 | 7 | | | | | | | |
| Valbert | | | | | | | 11 | | | 4 | | | 3 | | |
| Velasco | | | | | | | | 3 | | | | | | | |
| Vilella | 1 | | | | | | 3 | | | | 1 | 17 | 20 | 1 | 2 |
| Vistabella | | | | | | 5 | 1 | 1 | | | | | | | |
| Total | 1 | 1 | --- | --- | 3 | 62 | 170 | 83 | 6 | 29 | 9 | 55 | 170 | 8 | 9 |
| Total by groups | | | | | 318 | | | | 99 | | | 187 | | | |
| Percentage by groups: with relation to total | | | | | 52.65 % | | | | 16.39 % | | | 30.96 % | | | |

Soils in this group contain a high percentage of loam, ranging from 30 to 40 percent. There is usually approximately the same percentage of clay in this type soil, and in the heaviest of this class the clay content was observed to be 50.68 percent, but ranging from 48.03 percent to 41.71 percent, on the average. The proportion of fine and coarse sands ranges from 15 percent to 20 percent. In the heaviest soil the proportion of sand is as low as 6.42 percent. Of the sand content, the larger proportion is fine sand, and sand of over 2 mm. in diameter comprises only 3.91 percent on the average in this class.

This is a limestone soil, and the analysis indicates that the "burnt limestone" comprises 23 percent to 45 percent of the chemical content. On the average the soils in this class contain only .2 percent of phosphoric acid, and the nitrogen content varies from 1 to .73 parts in one thousand.

Type B: The type B soils are characterized by falling into No. 12, 13, 14, and 15 of the scale of Kopecky. The soils occur in higher elevations in the district and consist of fine, light, alluvial sand.

Soils of this type are a transitional type between the low heavy soils and the lighter higher soils. This is a minor soil type in this citrus district and only 16.39 percent of the district area may be so classified.

On the average these soils contain 50 percent coarse sand and 25 percent clay.

Chemical analysis indicates a lower "burnt limestone," phosphoric acid and potash content than group A. The nitrogen content is also low, averaging .70 parts in 1,000.

Type C: Type C soils may be classified as those in the Nos. 16, 17, and 18 of the scale of Kopecky. These are very light soils consisting of considerable percentage of both sand and gravel and lie at high levels in the citrus district. Both type B and C soils are irrigated with pumped water as are 74.5 percent of the groves in this district.

The dominant character in this high, excellent orange soil is the high proportion of coarse sand which ranges from 50 percent to 70 percent of the soil content. The amount of clay is low, ranging from 15 percent to 20 percent.

The soils in this class are loose and are generally lower in "burnt limestone" content than either class A or B. The nitrogen content is also low, averaging .50 parts in 1,000, and the phosphoric acid and potash content average .60 and .20 parts in 1,000 respectively.

Summary: As a result of this study, three distinct types of citrus soils in this district are determined: the heavy clay loam soil lying at low level, the lighter soils on elevations immediately above the low lands, and the very light gravelly soils in the highland. It has also been determined that there has been a distinct difference in the quality of similar varieties of fruit on the different qualities of soils. The poorest quality of orange is produced by trees on the low part of the district in soils which may be classified as loam and in Nos. 11 and 12 in the classification of Kopecky.

Oranges of fine quality are produced in the higher lighter soils which include classification B and C. The poor quality fruit on the low soils is all irrigated by gravity water. The better quality fruit is raised in the groves planted on the lighter soil and higher elevations, all irrigated by pumped water.

The type of soil also has a distinct effect upon the growth of the trees. In sandy soils the fruits are larger, have thinner peels and better quality juice, and are rich in sugars. The trees grow to a large size.

Where oranges are grown on heavy soils the trees do not grow to such large size, the fruit of the same variety in the same season is generally of smaller size, the peel is thicker, and there is less juice and sugar in the fruit.

This study of the soils in the vicinity of Alcira is a fine example of, not only the problems and nature of Spanish citrus culture, but also of the type of work being carried on by the Citrus Experiment Station at Valencia.

## SPANISH CITRUS VARIETIES

### Oranges

Comuna: The Comuna, a non-blood orange containing about 11 seeds on the average, is the most important orange variety in Spain. This orange and the seedless Cadenera are often called "white" or "blond" oranges.

The Comuna fruit is roughly round; it has grained skin and is juicy and of good flavor. It is harvested from November 15 to spring and is an important variety in the Ribera. When planted in good soil, the trees grow to large size and bear well.

Cadenera: The Cadenera is the partner to the Comuna in the "white" or "blond" category. It is probably the second most important orange variety in Spain. It is a non-blood, similar to the Comuna, but it is more oval in shape and is seedless. It is harvested from November 15 to spring. Like the Comuna, the trees grow to large size on good soil and bear well. Spanish citrus growers state that this variety is favored in Sweden. Both the Comuna and the Cadenera are suitable for processing purposes, and in Spain they comprise the largest source of juice fruit.

Washington navel: At present the Washington navel is probably the third most important orange variety and the acreage of this variety has increased rapidly in the last 15 years.

Doble Fina (double-fine): This is a blood orange known in the trade as the blood oval. At maturity in March it is a beautiful oval fruit with a rather smooth skin, which is a deep orange color with areas of red pigmentation. The interior is blood red at maturity. This is a mid-season orange, following the blond and navel varieties, and is harvested from January 1 to summer. Toward the end of the season this variety is said to have a tendency to dryness. This is the most acid of the Spanish blood varieties and has a tough skin which gives it excellent shipping qualities; it is considered the best of the Spanish blood oranges. As a group, the blood varieties are second in importance only to the blond group.

Entre Fina: This is a rough-skinned blood orange harvested from January 1 to early summer. It is juicy and palatable, but is considered by Spanish growers to be an orange of lower quality than the Doble Fina.

Verna (Berna): This is a late non-blood orange, oval in shape, which is harvested after the middle of April. On the average the fruit contains about four seeds. This variety shares the late orange season with the Valencia late and is preferred by some Spanish growers because of its good shipping qualities. In North Africa the Verna is not regarded as superior to the Valencia late.

Valencia late: This late non-blood orange, similar to or the same as our Valencia, is planted less extensively than the Verna. It is rounder, more juicy, and more acid than the Verna and in Spain is harvested from April through the summer.

Other Orange Varieties: Below are listed other minor orange varieties planted in Spain.

Moro--------An Italian blood orange.
Murtera 5/-A blood orange.
Imperial 6/- A non-blood orange.
Macetera 6/- A non-blood orange.

Tangerines

Tangerines are quite important to the Spanish citrus industry and about 10 percent of the sweet orange acreage is planted to these varieties.

Clementine: This orange-tangerine hybrid has been planted in Spain, but less than 1 percent of sweet orange acreage is devoted to its culture. It has been an erratic producer, and for this reason many groves are being top-worked to other varieties.

Common Tangerine: (Mandarine Comun) This tangerine variety is the most widely planted of this variety group.

Owari Satsuma: A very minor variety in Spain.

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5/ This is listed as a blood orange in accordance with Spanish classifications; however, the author has never personally identified it.

6/ The same statement applies to these two supposedly non-blood varieties.

Table 8.--Spain: Percentage of sweet orange acreage planted to each variety, 1937 and 1945 1/

| Variety | Percentage of Acreage | |
|---|---|---|
| | 1937 | 1945 |
| Blonds (Cadenera-seedless and Comuna-seeded) | 43.27 | 30.27 |
| Blood oval (and other bloods) | 33.83 | 34.58 |
| Tangerines | 9.72 | 9.72 |
| Washington navel | 5.65 | 17.64 |
| Verna (Berna) | 5.94 | 5.94 |
| Clementine | | .60 |
| Satsuma | | .25 |
| Valencia late | | .20 |
| Other varieties | 1.59 | .80 |

1/ La Riqueza Citricola Espanola, by Luis Roson Perez, page 63.

Table 9.--Spain: A comparison of the weight changes by months of seven Spanish orange varieties. An average of 10 fruits of each variety 1/

| Variety | Average weight of one fruit in grams | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March | April |
| Washington navel | 25.0 | 51.0 | 80.0 | 126.0 | 155.0 | 212.0 | ----- | ----- | ----- | ----- |
| "Doble Fina" (Blood) | 6.8 | 13.0 | 41.0 | 66.0 | 96.0 | 106.5 | 119.7 | 128.6 | 135.0 | ----- |
| Verna | 13.5 | 28.0 | 39.0 | 54.8 | 82.1 | 83.2 | 106.2 | 119.0 | 125.7 | ----- |
| Cadenera (Non blood-seedless) | 18.5 | 55.0 | 85.0 | 130.0 | 178.0 | 212.5 | ----- | ----- | ----- | ----- |
| Valencia | 8.1 | 25.7 | 44.6 | 52.8 | 100.5 | 108.0 | 124.5 | 139.5 | 150.0 | ----- |
| Common Tangerine | 2.7 | 10.1 | 25.9 | 51.8 | 78.5 | 102.5 | ----- | ----- | ----- | ----- |
| Comuna (Non blood-seeded) | 15.5 | 45.5 | 80.0 | 118.0 | 140.0 | 160.0 | 170.0 | 178.0 | 180.0 | ----- |

1/ Source: "Analisis de elementos nutritivos en el fruto, la flor y el tallo del naranjo," by Manuel Herrero Egana, Agricultural Engineer, Director, and Alejandro Acerete Lavilla, Agricultural Engineer, page 160.

Table 10.--Spain: Characteristics of the most important Spanish commercial varieties of oranges and tangerines, determined by laboratory analysis, indicating the district from which each sample was obtained.1/

| Variety | Province 2/ | District 2/ | Date of Analysis | Characteristics of the fruit (average value) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Length M.M. | Diameter M.M. | Ratio diameter to length | Weight grams | Volume c.c. | Density | Weight of peel percent | Thickness of peel M.M. | Fruit segments No. |
| Tangerine | Valencia | Culbera | 11-9-48 | 44.8 | 61.5 | 1.23 | 93.04 | 101.10 | 0.920 | 19.12 | 1.819 | 11.22 |
| Clementine | Valencia | Raplguaraf | 11-12-48 | 50.1 | 54.8 | 1.089 | 76.30 | 84.70 | 0.901 | 24.60 | 2.461 | 9.52 |
| Washington navel | Valencia | Fabernes de Valldigna | 12-10-48 | 80.1 | 82.0 | 1.021 | 265.74 | 290.90 | 0.913 | 23.29 | 3.723 | 10.10 |
| Cadenera (non-blood) | Valencia | Carcagente | 3-5-48 | 70.2 | 70.1 | 0.996 | 167.70 | 193.10 | 0.868 | 31.77 | 4.631 | 9.58 |
| Comuna (non-blood) | Valencia | Corbera de Alcira | 3-5-48 | 69.8 | 73.3 | 1.064 | 193.00 | 218.60 | 0.883 | 27.26 | 4.346 | 10.68 |
| Doble fina (blood) | Valencia | Gandia | 1-18-49 | 61.0 | 55.6 | 0.909 | 94.60 | 101.50 | 0.932 | 28.79 | 3.495 | 10.56 |
| Murtera (blood) | Valencia | Sagunto | 2-23-49 | 64.8 | 62.2 | 0.956 | 128.98 | 142.14 | 0.907 | 30.96 | 4.078 | 10.58 |
| Macetera (non-blood) | Alicante | Orilmela | 1-14-49 | 65.2 | 68.3 | 1.042 | 159.60 | 170.40 | 0.936 | 18.75 | 2.345 | 9.98 |
| Berna (Verna) (non-blood) | Murcia | Ulsa | 4-7-49 | 73.3 | 65.4 | 0.887 | 155.20 | 170.40 | 0.911 | 27.66 | 3.961 | 8.88 |

| Variety | Characteristics of the juice | | | | | | | | Seeds | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Density | Soluble solids 3/ | Acidity 4/ | Glucose 5/ | Sucrose 6/ | Ratio of sugar to acid | Ascorbic acid 7/ | Percentage of the juice in the fruit 8/ | Average number | Average weight in grams |
| Tangerine | 1.045 | 110.0 | 12.25 | 29.28 | 60.70 | 7.34 | 35 | 58 | 25.48 | 0.146 |
| Clementine | 1.039 | 96.7 | 9.10 | 25.62 | 55.14 | 8.87 | 56 | 59 | 3.86 | 0.145 |
| Washington navel | 1.046 | 113.3 | 11.55 | 46.59 | 48.47 | 8.23 | 51 | 61 | --- | --- |
| Cadenera (non-blood) | 1.050 | 121.7 | 15.35 | 44.08 | 39.26 | 5.43 | 67 | 54 | 0.80 | 0.132 |
| Comuna (non-blood) | 1.052 | 126.7 | 13.65 | 45.55 | 45.25 | 6.65 | 71 | 55 | 11.58 | 0.179 |
| Doble fina (blood) | 1.042 | 104.0 | 15.40 | 37.96 | 33.48 | 4.63 | 55 | 51 | 4.50 | 0.094 |
| Murtera (blood) | 1.048 | 116.7 | 17.85 | 41.00 | 43.04 | 4.70 | 59 | 49 | 5.38 | 0.135 |
| Macetera (non-blood) | 1.046 | 113.3 | 13.65 | 41.00 | 44.81 | 6.29 | 74 | 64 | 5.46 | 0.216 |
| Berna (Verna) (non-blood) | 1.056 | 136.0 | 10.85 | 52.56 | 79.89 | 12.20 | 70 | 53 | 4.18 | 0.158 |

1/ Source: Fdo Eusebio Gonzalez, Sicilia Agricultural Engineer, Burjasot (Valencia), October 4, 1949.
2/ Samples tested obtained from districts and provinces as indicated.
3/ Soluble solids are expressed in grams per liter.
4/ Acidity is expressed in grams of crystallized citric acid with one molecule of water per liter.
5/ Glucose is given as the total sugars reduced, expressed in grams per liter.
6/ Sucrose is given as the unreduced sugars, expressed in grams per liter.
7/ Ascorbic acid is expressed in milligrams per 100 cubic centimeters of juice.
8/ The yield of juice is expressed as a percentage of the weight of the fruit from which it was obtained.

Grapefruit

Grapefruit is a minor citrus variety in Spain; however, some is exported to western European markets. Spanish grapefruit was observed in Copenhagen, Denmark, in January 1949.

Below are listed the varieties planted.

Marsh Seedless: This is the most important variety in commercial production in Spain.

Duncan: This is a minor variety.

Triumph: This is another minor variety.

Lemons

Over 50 percent of the lemon acreage in Spain is in the Murcia province, but there are other important commercial plantings of lemons in the province of Malaga and Alicante.

Spanish lemon varieties are not clearly differentiated; however, the following descriptions may be helpful to an understanding of some of their characteristics.

Real: This lemon variety is said to be produced exclusively in the province of Malaga. This variety produces fruit which may be harvested from the end of August through January, with the best months for exportation September to November. Its primary advantage is that the fruit is produced at a time when the harvest of Italian lemons is low.

Verna (Berna): This Spanish lemon variety is the most important planted in Spain and is cultivated extensively in all the lemon producing provinces. It will be noted that the name applied to this lemon variety is the same as is applied to the late orange variety. This similarity in names is due to the fact that this lemon variety holds a comparable position to the Verna orange variety since it is late in maturing. This is a summer lemon, and the normal period of largest harvest is from March to August. In July 1949 lemons of this variety were observed to be harvested near Murcia. The fruit seen was just breaking in color, and some were larger than the sizes that would be considered most desirable for fresh fruit sale in the United States. The fruit was being wrapped and shipped in bulk to Switzerland.

Primofiori: This name is used to designate a lemon variety raised exclusively in the provinces of Murcia and Alicante. It is apparently an Italian lemon which has been planted in Spain, and the name Primofiori is an Italian term applied to a bloom of lemons in Italy. This is a minor lemon variety.

Verdelli: Spanish publications also refer to this lemon variety which is the term Italians apply to a lemon bloom which produces summer fruits. This is also undoubtedly an Italian lemon variety and is of minor importance in Spain.

Comun (Common lemon): A lemon with this name is referred to in Spanish literature and this term applies to a group of lemons, some of which may not be of propagated stock. It is stated that this variety produces winter lemons. It is a very minor variety.

## Analyses of Citrus Varieties

The above listing of Spanish citrus varieties is hardly adequate for an understanding of their characteristics. Fortunately, Spanish scientists have made several analyses of citrus varieties which will be useful in this regard.

The tabulation of weight changes by months (table 9) will give some indication of seasonality as well as comparative fruit size.

The analysis of nine orange varieties by Eusebio Gonzalez-Sicilia (table 10) indicates some of the more important physical characteristics of this fruit as well as the chemical content of the juice. The Spanish varieties may be compared with the Washington navel, a variety well known to our citrus industry.

A further identification of Spanish citrus varieties is the study of carotin pigments of citrus fruits by Eusebio Gonzalez (table 11). In this study, the peel, juice, and pulp of each variety have been analyzed and the more important varieties were tested several times to obtain a measure of seasonal change in carotin content

The conclusion of this study is also given below and should be an excellent guide to an understanding of Spanish citrus varieties. The comments of the author regarding comparison between Spanish and United States citrus are most interesting.

### Carotinoid Content of Some Spanish Citrus Varieties 7/

To begin with, great variability is observed in the carotinoid content from one variety to another, and within the same variety according to the season when the sample is drawn, or according to its degree of maturity.

Naturally, the varieties having a higher content of carotinoid pigments are those of late oranges, i.e. the berna (verna) and the late Valencia, both in the peel and in the pulp and juice. This predominance is very clearly shown in the analyses made during the month of May, i.e. when the fruits of these varieties reach full maturity; of these two varieties, a higher content is observed in the Berna as far as the peel is concerned, while the carotinoid content in the late Valencia is higher in the pulp; the juices of both have an equal content of pigments.

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7/ Spain. Ministerio de Agricultura. Instituto Nacional de Investigaciones Agronomicas. Estacion Naranjera de Levante (Ministry of Agriculture. National Institute of Agronomic Investigations. Orange Station of the Levant). Burjasot, Valencia, May 1949. Estudio de los Pigmentos Carotenoides en los Frutos de los Agrios (Study of the Carotenoid Pigments in Citrus Fruits), by Agr. Eng. Eusebio Gonzalez-Sicilia.

These late varieties are followed by those of mid-season, among which the blood oranges are outstanding as far as the peel is concerned, followed by the Common-orange; both in pulp and in juice the Murtera occupies first place, followed by the other varieties cited as having similar values, the last place in this group, as regards pulp, being filled by the Doble Fina and the Entrefina, which are the poorest in carotinoids.

Ahead of the early varieties of oranges, which are those of lower content, are found the tangerine. Of these the Common Tangerine is the one having the lowest content in pulp and juice, but the same is not true of the peel of this variety, which has a similar carotinoid content to that of the peel of the other varieties of this species.

The last place, with values very inferior to those of the oranges and tangerines, is occupied by lemons and grapefruit. The grapefruit contain a larger quantity of carotinoid pigments in the peel than the lemons, while in contrast the lemons have a higher content in the juice and pulp than the grapefruit.

A correlation is observed between the carotinoid content and the coloration of the fruit; with a more intense coloration there is a higher content of carotinoid pigments; this correlation is not an exact parallel because not all the pigments in citrus are carotinoids, but along with these there are others of a different chemical nature. The most conspicuous example that we have is the red pigment of the blood varieties, to which they owe their name; this is a case of a water-soluble pigment, of a red color in an acid medium and green in an alkaline medium, insoluble in organic dissolvents, and having another series of properties which separate it clearly from the carotinoids; this is a case of an anthocyanin. On the other hand, the red pigment of the pink grapefruit is lycopene which, as we have said before, is a carotinoid non-transformable into Vitamin A.

Comparing the figures obtained in our work with those obtained by Miller for juices of Florida oranges, it is noted that the oranges from our zone of the Levant are frankly superior to those from Florida with respect to content of carotinoid pigments, since the results obtained by us are about triple, in like manner to the case with Italian oranges, according to Carrante. We attribute this superiority to the natural characteristics of our varieties, and the difference in climatic conditions between the Spanish Levant and Florida, since the growth of our citrus fruits under conditions close to the limit of cultivation causes our fruit to develop a maximum of quality. The low winter temperatures close to zero (Centigrade), although they bring with them the risk of frost, color the fruit strongly, a condition which can never be achieved in the vicinity of the tropical zone.

In our judgment the peel of oranges and tangerines constitutes a good raw material for the industrial extraction of carotene.

Table 11.—Spain: Carotinoid pigments contained in the different parts of Spanish citrus fruits 1/

| Variety | Date | PEEL (mg./kilo) | | | | JUICE (mg./liter) | | | | PULP (mg./kilo) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total carotinoids | Xanthophill | Cryptoxanthin | Carotin | Total carotinoids | Xanthophill | Cryptoxanthin | Carotin | Total carotinoids | Xanthophill | Cryptoxanthin | Carotin |
| **Tangerines** | | | | | | | | | | | | | |
| Owari Satsuma | 23 November | 97.46 | 9.03 | 13.63 | 74.80 | 13.43 | 0.95 | 2.30 | 10.18 | 26.57 | 1.85 | 2.82 | 21.90 |
| Owari Satsuma | 30 December | 135.90 | 6.49 | 15.45 | 113.96 | 17.49 | 1.45 | 1.06 | 14.98 | 32.91 | 1.84 | 2.29 | 28.78 |
| Clementina | 25 November | 89.57 | 5.74 | 10.42 | 73.41 | 7.27 | 0.53 | 0.64 | 6.10 | 22.94 | 2.75 | 1.46 | 18.73 |
| Clementina | 31 December | 113.29 | | 18.49 | 94.80 | 11.34 | | 1.23 | 10.11 | 25.41 | | 2.30 | 23.11 |
| Common tangerine | 26 November | 79.99 | 4.24 | 10.34 | 65.41 | 7.62 | 0.26 | 0.73 | 6.63 | 12.84 | 0.60 | 1.50 | 10.74 |
| Common tangerine | 3 January | 113.81 | | | 113.81 | 8.29 | 0.60 | | 7.69 | 18.93 | 0.33 | | |
| Common tangerine | 2 February | 132.16 | | 7.07 | 125.09 | 15.03 | 0.15 | | 14.88 | 16.82 | | | 16.82 |
| **Oranges** | | | | | | | | | | | | | |
| Imperial | 6 December | 31.46 | 5.61 | | 25.85 | 9.03 | 0.76 | | 8.27 | 6.72 | 0.68 | 0.57 | 5.47 |
| Washington Navel | 30 November | 50.38 | 3.41 | 3.57 | 43.40 | 1.91 | 0.26 | | 1.65 | 12.20 | 2.24 | | 9.96 |
| Washington Navel | 4 January | 62.34 | 0.64 | 8.97 | 52.73 | 5.89 | 0.33 | 0.75 | 4.81 | 24.16 | 2.97 | 0.85 | 20.34 |
| Washington Navel | 5 February | 82.32 | 11.68 | | 70.64 | 6.51 | 1.10 | | 5.41 | 21.76 | 6.18 | 0.63 | 14.95 |
| Cadenera (non-blood, seedless) | 5 January | 66.05 | 14.87 | 2.65 | 48.53 | 5.66 | 0.11 | 0.43 | 5.12 | 19.75 | 2.45 | 1.87 | 15.43 |
| Berna (Verna) | 31 January | 83.64 | 15.38 | | 68.26 | 11.56 | 2.38 | | 9.18 | 22.35 | 3.50 | 0.34 | 18.51 |
| Berna (Verna) | 5 March | 150.05 | 40.86 | 6.31 | 102.88 | 13.08 | 2.25 | | 10.83 | 23.85 | 4.94 | | 18.91 |
| Berna (Verna) | 29 March | 202.44 | 22.87 | | 179.57 | 17.42 | 0.36 | 1.71 | 15.35 | 35.72 | 7.60 | 2.17 | 25.95 |
| Berna (Verna) | 5 May | 303.07 | 98.11 | 6.57 | 198.39 | 19.22 | 2.63 | 0.07 | 16.52 | 34.03 | 2.47 | 3.94 | 27.62 |
| Valencia Late | 1 February | 59.13 | 20.53 | 4.63 | 33.97 | 12.00 | 3.64 | | 8.36 | 17.40 | 1.40 | 3.38 | 12.62 |
| Valencia Late | 7 March | 142.83 | 10.39 | 3.68 | 128.76 | 12.97 | 1.64 | 0.71 | 10.62 | 33.89 | 2.09 | 2.59 | 29.21 |
| Valencia Late | 30 March | 184.61 | 11.22 | 15.56 | 157.83 | 17.56 | | | 17.56 | 43.11 | 10.56 | | 32.55 |
| Valencia Late | 4 May | 281.68 | 79.55 | 7.35 | 194.78 | 19.22 | 2.17 | 2.19 | 14.86 | 62.40 | 19.99 | 1.15 | 41.26 |
| **Grapefruit** | | | | | | | | | | | | | |
| Marsh Seedless | 7 January | 2.15 | 0.30 | | 1.85 | 0.07 | | | | 0.32 | | | |
| Duncan | 9 February | 4.12 | 1.71 | 0.81 | 1.60 | 0.11 | | | | 0.32 | | | |
| Triumph | 10 February | 2.15 | 0.75 | 0.31 | 1.09 | 0.17 | | | | 0.47 | | | |

See footnote on next page.

Table 11.—Spain: Carotinoid pigments contained in the different parts of Spanish citrus fruits 1/ (Continued)

| Variety | Date | PEEL (mg./kilo) | | | | JUICE (mg./liter) | | | | PULP (mg./kilo) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total carotinoids | Xanthophill | Cryptoxanthin | Carotin | Total carotinoids | Xanthophill | Cryptoxanthin | Carotin | Total carotinoids | Xanthophill | Cryptoxanthin | Carotin |
| Lemons | | | | | | | | | | | | | |
| Comun | 8 January | 1.04 | 0.37 | | | 0.28 | | | | 0.65 | | | |
| Berna | 8 February | 1.21 | | | | 0.36 | | | | 0.79 | | | |
| Berna | 9 March | 2.47 | 1.24 | | | 0.35 | | | | 0.96 | | | |
| Berna | 31 March | 2.72 | 1.12 | | | 0.34 | | | | 1.28 | | | |
| Berna | 6 May | 1.81 | 0.57 | | | 0.32 | | | | 0.81 | | | |
| Cadenera (non-blood seedless) | 7 February | 50.53 | 5.98 | 6.23 | 38.32 | 9.91 | 1.17 | 0.75 | 7.99 | 20.17 | 6.76 | | 13.41 |
| Cadenera (non-blood seedless) | 8 March | 149.05 | 29.68 | | 119.37 | 9.23 | 0.97 | | 8.26 | 37.85 | 9.22 | | 28.63 |
| Comuna (non-blood seeded) | 31 January | 59.68 | 21.22 | | 38.46 | 8.09 | 0.78 | | 7.31 | 18.37 | 1.70 | 2.06 | 14.61 |
| Comuna (non-blood seeded) | 4 March | 97.29 | 8.90 | 0.05 | 88.34 | 8.65 | 0.96 | 0.18 | 7.51 | 22.99 | 2.99 | | 20.00 |
| Comuna (non-blood seeded) | 28 March | 128.78 | 7.81 | 16.27 | 104.70 | 11.86 | 0.05 | 1.75 | 10.06 | 39.10 | 9.46 | 5.57 | 24.07 |
| Moro Catania (blood) | 25 January | 64.90 | 5.83 | 10.03 | 49.04 | 6.60 | 0.15 | | | 23.03 | 2.16 | 5.45 | 15.42 |
| Moro Catania (blood) | 26 February | 93.47 | 19.01 | 5.84 | 68.62 | 9.31 | 2.22 | 1.83 | 5.26 | 27.70 | 8.54 | 5.03 | 13.13 |
| Moro Catania (blood) | 21 March | 106.00 | | 26.20 | 79.80 | 11.52 | 1.58 | 1.88 | 8.06 | 37.95 | 6.20 | 9.60 | 22.15 |
| Doble Fina (blood) | 26 January | 27.27 | 0.03 | 3.37 | 23.87 | 8.42 | 0.12 | 1.01 | 7.29 | 12.39 | 1.60 | | 10.79 |
| Doble Fina (blood) | 28 February | 91.31 | 15.22 | 3.79 | 72.30 | 8.78 | 1.51 | 0.12 | 7.15 | 15.72 | 4.57 | 0.38 | 10.77 |
| Doble Fina (blood) | 22 March | 187.54 | 14.12 | 20.55 | 152.87 | 10.23 | 0.85 | 0.61 | 8.77 | 23.42 | 3.41 | 2.10 | 17.91 |
| Entrefina (blood) | 27 January | 40.65 | 0.99 | 2.27 | 37.39 | 8.62 | 0.95 | 0.48 | 7.29 | 17.59 | 0.68 | 1.01 | 15.90 |
| Entrefina (blood) | 1 March | 62.02 | 16.54 | 4.76 | 40.72 | 10.20 | 2.82 | 1.33 | 6.05 | 25.48 | 4.23 | 4.03 | 17.22 |
| Entrefina (blood) | 23 March | 207.62 | 26.57 | 37.39 | 143.66 | 12.39 | 0.16 | 0.82 | 11.41 | 28.16 | 4.65 | 2.09 | 21.42 |
| Murtera (blood) | 28 January | 49.85 | 4.58 | 0.74 | 44.53 | 11.07 | 0.78 | | 10.29 | 16.62 | 1.07 | | 15.55 |
| Murtera (blood) | 3 March | 134.73 | 24.74 | 17.71 | 92.28 | 15.15 | 4.02 | 1.62 | 9.51 | 39.24 | 11.34 | 1.61 | 26.29 |
| Murtera (blood) | 26 March | 157.85 | 34.03 | 19.43 | 104.39 | 17.70 | 3.03 | 3.48 | 11.19 | 48.94 | 15.87 | 5.65 | 27.42 |

1/ Source: Study of carotin pigments of citrus fruit. Orange experiment station of the Levante Burjasot (Valencia) by Eusebio Gonzalez, May 1949.

The total carotinoid pigment content in each variety of oranges and tangerines varies with its stage of maturity, an increase being generally observed during the process of ripening, an increase which continues, although with less intensity, after the fruit has reached full maturity, The exceptions to this general rule that we have found in our analyses are but few and can be attributed to external circumstances such as differences between the sample taken and the actual average of the fruit of the tree, or the disappearance of the ripest oranges, in which case the ramainder cannot be considered as showing a more advanced stage of maturity than that of the sample taken on a previous date.

We must make it clear that when the analyses of late oranges were interrupted in May for lack of fruit, we had been unable to verify the decrease in carotinoids that Miller mentions for the late Valencia; however, we must say that it is a matter of general observation that in the berna (verna), when summer comes, the orange loses color and becomes green again, to take on color again the following year; naturally this loss of coloration must be accompanied by a decrease in the content of carotinoid pigments.

We have observed in the lemon that the peel and pulp increase their carotinoid content during the ripening process, to decrease slightly at the end of it; on the other hand, the content of carotinoid pigments decreases in the juice when the fruit gets ripe.

By examining the accompanying table it can be seen that the major part of the carotinoids contained in the fruit is in the peel, and this quantity fluctuates between half and three-quarters of the total.

It is also deduced that, when an orange is squeezed to extract the juice, only a part of the carotinoid pigments in the pulp passes into the juice, this proportion being very variable since it fluctuates between 11 and 64 percent.

Burjasot, Valencia, May 1949
Agr. Eng. Eusebio Gonzalez-Sicilia

A still further illuminating study is the chemical analysis of seven orange varieties (table 12). Again in these data the Washington navel may be compared with the Spanish varieties. The Valencia late is also included in the tested varieties and may be used as a comparison. However, the Valencia late of Spain may not be exactly the same variety as the one we know as the Valencia.

Since these data cover tests over a period of 9 months for each variety, it is another guide to seasonality.

The summary of the findings of this work is given in full as follows:

Chemical Analysis of Seven Orange Varieties 8/

From the averages of the analyses made during the 1932-33 season of the fruits of seven varieties of orange, it is deduced that the tendency of the percentages

8/ Spain. Ministerio de Agricultura. Instituto de Investigaciones Agronomicas. Estacion Naranjera de Levante, Burjasot (Valencia) (Ministry of Agriculture. Institute of Agronomic Research. Levant Orange Station, Burjasot, Valencia.) Analisis de Elementos Nutritivos en el Fruto, La Flor y el Tallo del Naranjo (Analysis of Nutritive Elements in the Fruit, Flower, and Stem of the Orange Tree), by Manuel Herrero Egana and Alejandro Acerete Lavilla, Madrid, 1937, pp. 126-127.

of the content of dry matter, nitrogen, phosphoric acid, potash, and lime in the orange is to decrease in approximately a standard pattern from July until October or November, remaining perceptibly constant during the following months. The tangerine gives a high figure for percentage of nitrogen in the month of June. The major variability in the principles analysed, with respect to the seven varieties, generally occurs during the months of July, August, and September. The maximum variability in nitrogen and potash is in August; that for phosphoric acid in September, and that for lime, in June.

The analyses made during the 1933-34 season of fruits from five trees of each of the following varieties:

Washington navel (early), double-fine blood (mid-season), and Verna (late) show that the differences found in the analyses of dry matter, nitrogen, phosphoric acid, potash, and lime, in the trees of the same variety, are not significant in the same month. The differences in the proportion of dry matter between the Washington and the blood are not significant in any month; the Verna, in August, is richer in dry matter than the other two; in September, more than the Washington navel, and in October, November, and December, more than the Washington navel and the double-fine blood. In the Washington navel, the percentage of dry matter in the fruit drops from July to September, and remains constant during October, November, and December; in the blood a similar decrease occurs; the most conspicuous differences between the verna and the other varieties correspond to the month of August. The nitrogen content in July and August is higher in the verna and double-fine blood varieties than in the navel; the highest quantitative difference occurs in July. There is more phosphoric acid in the verna than in the Washington during the months of July to November, inclusive; from October to December there are no significant differences between the blood and the verna, nor between the blood and the Washington; there are two drops in the Washington and the blood, one between July and August, and the other and smaller one between September and October; the verna shows a drop from September to October. The proportion of potash decreases in July and August, and remains almost constant from August to December, with few differences between the three varieties. The percentage of lime diminishes between July and August; in July the blood has a higher content than the others. The fruits from an average crop of the blood variety in March, when the fruit is ripe, contain about two kilograms more of dry matter per tree than the navel in picking time, and the verna, when ripe, exceeds the blood by a kilogram and a half per tree. The quantity of total nitrogen corresponding to the average crop per tree is, in nearly all months, higher in the verna variety than in the others. The Washington navel, in September, already contains more than half the total weight of nitrogen which the crop extracts; the blood, half, and the verna, less than half. The verna seems to need the same quantity of phosphoric acid as the blood to make a crop; the Washington navel, somewhat less than the others. The three varieties give a figure for total potash which is approximately equal for an average crop; the Washington navel, during the months from July to October, stores rather more potash in the fruit than each of the other varieties; the total for the crop is more than double as much in the Sangre and Verna varieties as in the Washington. In July, the fruits on a tree already contain rather more than 35 percent of the total quantity of lime extracted by the crop of the late varieties, and approximately the total quantity taken by the Washington navel.

Table 12.--Spain: A comparison of the seasonal changes in seven Spanish orange varieties concerning physical and chemical characteristics of the fruit

| Variety | July 1932 | | August | | September | | October | | November | | December | | January 1933 | | February | | March | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree | Percent of the weight of the fresh fruit | Total corresponding to the average crop per tree |
| | | Grams | | Grams | | Grams | | Grams | | Grams | | Grams | | Grams | | Grams | | Grams |
| **DRY MATERIAL** | | | | | | | | | | | | | | | | | | |
| Washington navel | 19.54 | 2.790.31 | 19.05 | 5.669.85 | 16.25 | 8.092.50 | 14.27 | 10.993.61 | 13.48 | 14.801.04 | 13.29 | 16.944.75 | --- | --- | --- | --- | --- | --- |
| Double fine (blood) | 20.16 | 1.302.34 | 19.92 | 3.595.56 | 17.50 | 7.148.75 | 15.14 | 9.392.10 | 15.07 | 12.040.18 | 14.05 | 14.215.09 | 16.46 | 18.717.49 | 15.25 | 18.630.93 | 14.10 | 18.083.25 |
| Verna (Berna) | 22.80 | 2.006.40 | 22.29 | 4.346.55 | 20.75 | 7.449.25 | 14.52 | 7.666.56 | 16.27 | 11.779.48 | 16.90 | 14.060.80 | 16.16 | 17.161.95 | 15.40 | 18.326.00 | 14.67 | 18.440.19 |
| Cadenera (non-blood seedless) | 19.89 | 2.207.79 | 20.61 | 6.801.30 | 16.85 | 8.593.50 | 11.77 | 9.180.60 | 13.63 | 14.556.84 | 14.92 | 19.023.00 | --- | --- | --- | --- | --- | --- |
| Valencia late | 23.60 | 1.624.86 | 23.83 | 5.205.66 | 19.64 | 7.445.52 | 15.48 | 6.947.42 | 16.98 | 14.505.17 | 17.03 | 15.633.54 | 16.25 | 17.196.56 | 15.75 | 18.675.56 | 14.96 | 19.074.00 |
| Common tangerine | 27.30 | 684.52 | 23.51 | 2.849.41 | 16.74 | 5.202.79 | 16.16 | 10.045.06 | 13.56 | 12.773.52 | 16.09 | 19.790.70 | --- | --- | --- | --- | --- | --- |
| Comuna (non-blood seeded) | 22.35 | 2.597.07 | 19.18 | 6.545.17 | 15.16 | 9.096.00 | 12.90 | 11.416.50 | 14.10 | 14.350.00 | 14.18 | 17.016.00 | 14.16 | 18.054.00 | 14.00 | 18.690.00 | 13.50 | 18.225.00 |
| **NITROGEN** | | | | | | | | | | | | | | | | | | |
| Washington navel | 0.408 | 58.26 | 0.252 | 75.00 | 0.260 | 129.48 | 0.140 | 107.86 | 0.119 | 130.66 | 0.120 | 153.00 | --- | --- | --- | --- | --- | --- |
| Double fine (blood) | 0.476 | 30.75 | 0.402 | 51.80 | 0.287 | 117.24 | 0.196 | 121.59 | 0.147 | 117.45 | 0.160 | 161.88 | 0.147 | 167.16 | 0.147 | 179.59 | 0.133 | 170.57 |
| Verna (Berna) | 0.390 | 34.32 | 0.346 | 67.47 | 0.265 | 95.14 | 0.231 | 121.97 | 0.133 | 96.29 | 0.175 | 145.60 | 0.168 | 178.42 | 0.147 | 174.93 | 0.126 | 158.38 |
| Cadenern (non-blood seedless) | 0.427 | 47.40 | 0.286 | 87.78 | 0.245 | 124.95 | 0.161 | 125.58 | 0.140 | 149.52 | 0.127 | 161.92 | --- | --- | --- | --- | --- | --- |
| Valencia late | 0.410 | 28.23 | 0.294 | 64.22 | 0.300 | 113.73 | 0.210 | 94.25 | 0.127 | 108.49 | 0.157 | 144.13 | 0.140 | 148.16 | 0.140 | 166.01 | 0.119 | 151.73 |
| Common tangerine | 0.532 | 17.25 | 0.402 | 48.72 | 0.329 | 102.25 | 0.231 | 143.59 | 0.154 | 145.07 | 0.140 | 172.20 | --- | --- | --- | --- | --- | --- |
| Comuna (non-blood seeded) | 0.410 | 47.64 | 0.302 | 103.06 | 0.246 | 147.60 | 0.168 | 148.68 | 0.147 | 154.35 | 0.140 | 168.00 | 0.140 | 178.50 | 0.135 | 180.23 | 0.135 | 182.25 |
| **PHOSPHORIC ACID** | | | | | | | | | | | | | | | | | | |
| Washington navel | 0.128 | 18.28 | 0.080 | 23.81 | 0.033 | 16.43 | 0.031 | 23.88 | 0.030 | 32.94 | 0.025 | 31.87 | --- | --- | --- | --- | --- | --- |
| Double fine (blood) | 0.128 | 8.27 | 0.127 | 11.06 | 0.079 | 32.27 | 0.033 | 20.47 | 0.033 | 26.37 | 0.030 | 30.35 | 0.031 | 35.25 | 0.030 | 36.65 | 0.024 | 30.78 |
| Verna (Berna) | 0.112 | 9.86 | 0.105 | 20.47 | 0.101 | 36.26 | 0.040 | 21.12 | 0.040 | 28.96 | 0.035 | 29.12 | 0.033 | 35.05 | 0.037 | 44.03 | 0.029 | 36.45 |
| Cadenera (non-blood seedless) | 0.112 | 12.43 | 0.075 | 24.75 | 0.041 | 20.91 | 0.029 | 22.62 | 0.035 | 37.38 | 0.015 | 19.12 | --- | --- | --- | --- | --- | --- |
| Valencia late | 0.107 | 7.37 | 0.092 | 20.10 | 0.112 | 42.46 | 0.030 | 13.46 | 0.038 | 32.46 | 0.020 | 18.36 | 0.031 | 32.81 | 0.040 | 47.43 | 0.020 | 25.50 |
| Common tangerine | 0.148 | 47.80 | 0.127 | 15.39 | 0.086 | 24.86 | 0.041 | 25.48 | 0.020 | 18.84 | 0.032 | 39.36 | --- | --- | --- | --- | --- | --- |
| Comuna (non-blood seeded) | 0.122 | 14.18 | 0.095 | 32.42 | 0.040 | 24.00 | 0.035 | 30.97 | 0.030 | 31.50 | 0.025 | 30.00 | 0.022 | 28.05 | 0.020 | 26.70 | 0.018 | 24.30 |
| **POTASSIUM** | | | | | | | | | | | | | | | | | | |
| Washington navel | 0.321 | 45.84 | 0.287 | 85.41 | 0.249 | 124.00 | 0.157 | 120.95 | 0.178 | 195.44 | 0.140 | 178.50 | --- | --- | --- | --- | --- | --- |
| Double fine (blood) | 0.310 | 20.03 | 0.409 | 40.25 | 0.209 | 85.38 | 0.196 | 121.59 | 0.163 | 130.23 | 0.125 | 126.47 | 0.130 | 147.83 | 0.154 | 188.14 | 0.141 | 180.83 |
| Verna (Berna) | 0.343 | 30.18 | 0.304 | 59.28 | 0.347 | 124.57 | 0.196 | 103.49 | 0.164 | 118.74 | 0.171 | 142.00 | 0.159 | 168.86 | 0.134 | 159.46 | 0.179 | 225.00 |
| Cadenera (non-blood seedless) | 0.361 | 40.07 | 0.245 | 80.85 | 0.262 | 133.62 | 0.181 | 141.18 | 0.167 | 178.36 | 0.126 | 160.65 | --- | --- | --- | --- | --- | --- |
| Valencia late | 0.414 | 28.50 | 0.335 | 73.18 | 0.325 | 121.41 | 0.198 | 88.86 | 0.146 | 124.72 | 0.163 | 149.63 | 0.169 | 187.84 | 0.134 | 158.89 | 0.170 | 216.75 |
| Common tangerine | 0.414 | 13.41 | 0.409 | 49.57 | 0.309 | 96.03 | 0.180 | 111.89 | 0.216 | 203.47 | 0.113 | 138.99 | --- | --- | --- | --- | --- | --- |
| Comuna (non-blood seeded) | 0.367 | 42.64 | 0.294 | 100.33 | 0.238 | 142.80 | 0.139 | 123.01 | 0.178 | 186.90 | 0.160 | 192.00 | 0.152 | 193.80 | 0.154 | 205.59 | 0.160 | 216.00 |
| **CALCIUM** | | | | | | | | | | | | | | | | | | |
| Washington navel | 0.370 | 52.84 | 0.144 | 42.85 | 0.130 | 64.74 | 0.050 | 38.52 | 0.050 | 54.90 | 0.050 | 63.75 | --- | --- | --- | --- | --- | --- |
| Double fine (blood) | 0.390 | 25.19 | 0.201 | 40.07 | 0.225 | 89.87 | 0.086 | 53.35 | 0.035 | 27.96 | 0.065 | 65.76 | 0.027 | 30.70 | 0.945 | 54.98 | 0.040 | 51.30 |
| Verna (Berna) | 0.290 | 25.52 | 0.242 | 47.19 | 0.125 | 44.87 | 0.090 | 47.52 | 0.080 | 57.92 | 0.075 | 62.40 | 0.095 | 100.89 | 0.085 | 95.20 | 0.042 | 52.79 |
| Cadenera (non-blood seedless) | 0.360 | 39.96 | 0.157 | 51.81 | 0.213 | 108.63 | 0.056 | 43.68 | 0.014 | 14.95 | 0.044 | 56.10 | --- | --- | --- | --- | --- | --- |
| Valencia late | 0.285 | 19.62 | 0.250 | 54.61 | 0.219 | 83.02 | 0.070 | 31.42 | 0.070 | 59.80 | 0.087 | 79.87 | 0.085 | 84.66 | 0.070 | 94.86 | 0.034 | 43.35 |
| Common tangerine | 0.510 | 16.52 | 0.201 | 24.36 | 0.231 | 71.79 | 0.180 | 49.73 | 0.053 | 49.93 | 0.036 | 44.28 | --- | --- | --- | --- | --- | --- |
| Comuna (non-blood seeded) | 0.498 | 57.87 | 0.157 | 62.45 | 0.207 | 124.20 | 0.059 | 52.21 | 0.049 | 51.45 | 0.060 | 72.00 | 0.050 | 63.75 | 0.040 | 53.40 | 0.030 | 40.50 |

The relative increase in the weight of the fruit, percentagewise and per week, begins to decrease starting in July, reaching lower values in the early varieties than in the late, as was to be expected.

Comparing the annual variations in percentage of nitrogen corresponding to the fruits analysed during the two seasons mentioned, it is seen that they are generally smaller than those due to the variety.

The spring growth is richer in phosphoric acid than the later growth, in all the varieties analysed; the same is true of lime, except for the Valencia variety, and the contrary holds for potash.

The content of phosphoric acid, nitrogen, potash, and lime is higher in the flowers of the tangerine than in the other varieties of orange.

Floration presupposes a rapid mobilization of some 150 grams of nitrogen and an equal quantity of potash per tree to form the seven kilograms and a half of dry matter contained in the 74,000 blooms, which in approximate figures, are produced by one tree.

In the first growth, the total nitrogen per tree is higher than in harvest and in floration; this is true to a larger extent of the phosphoric acid, and very much more so of lime; the potash enters into the floration and the crop, with as great or greater intensity than into the spring spurt of growth.

The comuna and cadenera probably deserve some attention as possible processing varieties since they are of about the same season as the Washington navel.

With the description and the analyses I have attempted to bring together information which will make more definite identification of Spanish citrus possible and will lead to an understanding of their composite merits as regards our citrus varieties.

Spain produces beautiful fruit; the blood oval in particular is very impressive at maturity and is interesting commercially since it brings higher prices in European markets than United States citrus of the same season.

## CULTURAL PRACTICES

In the description of the Spanish citrus districts we have mentioned some of the more important cultural practices that differentiate one district from the other. With regard to economic conditions and cultural practices rather more detail has been given with regard to the district of Murcia than has been given for the other sweet orange district. The additional information regarding Murcia was included with the discussion of the citrus districts because Murcia is the largest lemon producing area in Spain.

In the following discussion we shall consider the general observations regarding Spanish citrus culture in the sweet orange districts with primary interest upon the citrus culture in the area from Gandia to Castellon. This is the primary area of production of sweet oranges. The other two important citrus areas in Spain are Murcia, mentioned above, and the area of the bitter orange, where the center of production is Seville. This area will be discussed in a separate section later.

Cultivation

Cultivation of Spanish citrus orchards is accomplished almost entirely by hand, utilizing a heavy hoe-like implement with a handle about 4 to 4½ feet long. The majority of the groves are less than two acres in size, and because of the methods used the term garden would be more applicable. Since cultivation is by hand, every available section of the land can be utilized for the production of citrus fruit or for other food crops for family use. In larger groves, after the ground has been tilled by hand-digging, light horse-drawn implements are used to break up the large clods of dirt and to relevel the ground. Horse-drawn implements may also be used in the larger groves for the construction of borders used to control irrigation water. Generally the practices of cultivation are excellent, and, because hand tools are used, the job of cultivation is neatly and thoroughly done without the disadvantage of creating plow soles. That the orchard practices in Spain are highly effective is evidenced by the yield record which accompanies the cost data in this study.

The author observed one grove of very large trees in the Ribera being raked, and all the leaves under each tree were being brought to the center of a row and buried.

In performing the various hand cultivation jobs, various types and shapes of hand tools are used, but all those observed were of the short-handle type. While this method of cultivation requires great amounts of hand labor, the results are excellent.

Pruning

In Spain all varieties of citrus trees are heavily pruned with the practice being most severe in the region of Castellon. In March 1949, pruning was observed in orange orchards after the fruit had been picked. The skirts of the tree are raised to about 3 feet from the ground, and the tree is opened up in the center so there is a cone-like face in the center of the tree. Since the groves are closely planted, the trees are also kept quite small. It was interesting to observe how much wood was removed in pruning. Some growers said it was common practice to remove all third-year wood. The tools used are a small hatchet-like instrument and knives and shears such as are used in our orchard practice.

It was stated by some growers that the pruning was done to increase both the quality and the size of the fruit. These growers pointed out that, in their experience, the quality of oranges grown on the lower portion of the tree, or skirts, and on the top were of much lower quality than the fruit raised on the interior of the tree and around the central portion of the carrying surface.

Where pruning was observed, the limbs removed from the tree were collected in the orchard middle. Then they were tied into bundles and carried out of the orchard to a farm building. There the prunings were piled and left to dry until such time as the leaves could be shaken from the wood. The leaves were then used as food for domestic animals such as sheep and goats. The remaining twigs and wood were utilized for firewood. This is an excellent illustration of the shortage of both fodder and firewood in both Spanish districts, and it also illustrates the great economy exercised in the growing of citrus.

It is interesting to observe that the citrus areas where pruning is practiced very extensively are almost universally areas in which grapes were grown at an earlier date. Is it possible that the practice of pruning is a hold-over from grape culture to the present citrus culture?

The Spanish citrus groves produce a high quality orange, and their pruning practices may well be one reason for the quality of the crop. The practice of severe pruning is so widespread and traditional that it may have sound basis in fact although the reasons may not be immediately apparent. All of the pruning observed was expertly done.

Nurseries and Nursery trees

There are a few commercial nurseries in Spain, but the majority of citrus trees are raised on the farm by the growers. This practice must certainly result in uniform selection of sources of the sour root stock, and of scion.

When a grower desires to change his orchard from one variety to another, it is not the practice to remove the trees but to top-work the existing orchard. Many of the orchards seen had been top-worked several times. This helps to spread such diseases as psorosis, and, while this disease was originally introduced on the navel varieties, it is probable that the practice of top-working will spread the disease to other varieties.

In the Castellon area one-year old nursery trees in the 1948-49 season cost approximately 3.75 pesetas (£.17) for Valencia lates and approximately 2.50 pesetas (£.15) for the blood oval and other varieties. Nursery trees for this area are raised a considerable distance away, primarily north of Vinarroz. The trees are balled, the roots being protected with a covering of straw held in place by twine during shipment from nursery to grove. Trees observed were not trained in the same manner as are those in good commercial practice in the United States. At the bud union a stub of the seedling is left about 2 inches long, this not being removed until the tree is well established in the orchard. Apparently, the trees are not headed at any definite height, and the lateral limbs are permitted to grow out near the ground, so that in orchards the head of the tree may be within one foot to 1½ feet of the surface. All varieties are raised on sour root stock.

Disease Control

In all districts, the practice of building basins around the tree to keep irrigation water away from the trunk is an effective preventive of gummosis. When a trunk becomes infected the diseased area is removed by scraping. Some of the observed treatment of this type was extensive, and one grower stated that a man at times spends 2 days on a single tree in performing major treatment work. Since the trees are headed low, diseased heart wood may be entirely removed, leaving a hollow central trunk of the tree. Near Carcagente, in some old orange groves of the Comuna variety raised on trifoliate stock, the entire original root has been removed, leaving a hollow trunk with the roots formed by growing out of the scion stock. Trees of 75 years of age treated in this manner are still growing in healthy condition, and some of them are nearly 6 meters or approximately 18 feet in height.

Psorosis: Outbreaks of psorosis are observed in all citrus areas of Spain, primarily on navel trees. A few growers practice treatment by scraping. However, most groves are untreated. Since groves are closely planted, it would seem likely that this disease will spread from the navel to other citrus varieties. Nursery trees are mostly home grown, and there is no method by which trees are certified as being free from disease. In the past, citrus trees were imported into Spain from California. One large grower near Carcagente is said to have imported 10,000 trees from this source.

From cultural conditions and lack of supervision in raising nursery stock, it would seem likely that psorosis will be an increasingly serious menace to the productivity of Spanish citrus.

Spanish Citrus Pests

The spread of scale infestation of the Spanish citrus industry is interestingly described in the following quotation from a report on scale insects which attack citrus by Federico Gomez Clementi. 9/ This is a translation from the Spanish. 10/

Mytilococcus beckii and M. gloverii, coming from the Far East, have been found in Spain for a good many years, but although the first-named began to do damage on a date which is known with some accuracy, the same is not true of the latter, date on its arrival in the Spanish orange groves being inexact.

In 1868, attention was called to the presence of the species M. beckii in Catalonia by Martorell y Pena, who found important centers of infestation in San Vicente de Sarria during the years 1870 and 1872. It was not long before it appeared in places rather distant, such as Tiana, Alella, Porta, Mataro, and various others in the province of Barcelona. Dr. Colvee, observing the enormous damage which it caused to the orange trees in Catalonia, called attention to the importance which this pest would have in the Valencian provinces, where this tree was already one of the principal crops at that time.

The pest was limited to the districts of Catalonia for some time, but was undoubtedly continuing its travels to the South, although slowly, in search of the rich orange-growing districts of Castellon and Valencia. In 1894, i.e. 26 years after its appearance in Catalonia, the voice of alarm was raised in the province of Castellon, when this scale insect was observed in

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9/ Source: SPAIN. MINISTERIO DE AGRICULTURA. INSTITUTO NACIONAL DE INVESTIGACIONES AGRONOMICAS. ESTACION DE FITOPATOLOGIA AGRICOLA DE BURJASOT (VALENCIA). Trabajos (Serie Fitopatologia) num. 150 (MINISTRY OF AGRICULTURE. NATIONAL AGRONOMIC RESEARCH INSTITUTE. AGRICULTURAL PLANT PATHOLOGY STATION AT BURJASOT, VALENCIA). Report (Plant Pathology Series) no. 150 (SCALE INSECTS WHICH ATTACK CITRUS): LAS "SERPETAS" QUE ATACAN A LOS AGRIOS: Mytilococcus Beckii (Newmann) y Mytilococcus Gloverii (Packard), by Federico Gomez-Clemente, Agr. Eng.

Georgraphical Data, p. 3-5

10/ Translated from the Spanish by May Coult, Translator for the Office of Foreign Agricultural Relations, USDA.

numerous orchards, and the area then affected indicated that the invasion had not been recent, but that the insect must have reached, several years earlier, favorable places for its development, and these had served as centers for its dispersion.

As the scale was located in Castellon orange groves just across from those in Valencia, it was soon to appear in the northern districts of the latter province which compose the Sagunto zone. However, the invasion of the rich districts of Alcira and Caracagente must have taken place during the early years of the present century, since Agr. Eng. Ascarate, in his book on this scale insect which was published in 1895 (1), refers to the existence of this pest only on the Plain of Castellon. The insect was progressing constantly, and the transportation of plants, which was already very important, contributed to this advance, in addition to its natural expansion.

At the present time, Mytilococcus beckii is found in the majority of the orange-growing districts on the Mediterranean littoral as the sole species, or together with M. gloverii. In addition to the provinces of Castellon and Valencia, it is listed in those of Alicante, Almeria, Barcelona, Malaga, Tarragona, and the Canary Islands. It also exists, and is widely disseminated over the Melilla and other zones in the Spanish Protectorate of North Africa.

In the Valencian region it prefers to live in the orchards situated all along the coastal zone, protected by the mountain chains which run parallel to the littoral. There are important centers of infestation in Sagunto, Puzol, Betera, Moncada, Oliva, etc., of Valencia; Nules, Burriana, Villarreal, and other districts in Castellon, as well as in Pego and Vergel, in Alicante.

The information which has motivated the study of these scales of the Auranciaceae has not revealed to us the date of the arrival of M. gloverii in the Mediterranean zone. Both Salas Amat and Giner Alino mention it as a parasite of the orange and lemon, but without describing it or indicating its geographic distribution. This proves that the then cause for worry was only the existence of the other species, which they review at considerable length.

It may very well be considered that its entrance into Spain came with the present century 11/, on citrus planting material from distant countries, since it did not exist in Italy nor in the orange-growing zones of Northern Africa.

Once the gloverii scale was established in certain districts of Valencia, it lost no time in becoming alarmingly serious, thus intensifying the problem which already existed for the farmer because of the infestation of his orange trees with other scale insects. Among these was the "red louse" or "poll-roig" (Chrysomphalus dictyóspermi Morgan), which threatened to destroy the orange crop, thus making it urgently necessary to take measures to reduce its depredations. From its arrival in the province of Valencia and the northern part of the province of Alicante some time had elapsed before it reached the orange trees on the lowlands of the Segura. It is supposed that, while important foci existed in the orchards of Orihuela, penetration into the province of Alicante from the orange-growing area of Murcia it took about ten years for it to invade the trees around Murcia.

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11/ In his work entitled "Enfermedades del naranjo" (Diseases of the orange tree), published in Valencia in 1904, Agr. Eng. Manuel Sanz Bremon describes Mytilaspis gloverii, and the drawings which accompany the text abundantly prove that it is a discussion of this species.

It is the typical species on the orange trees of the Levant, where in some cases it lives in association with M. beckii, although dominant over the latter; in other cases it is the only pest belonging to the genus Mytilococcus. More than that, in some orange-growing districts of Valencia where M. beckii was established first, and where it was abundant a few years ago, foci are hardly found today, or they are reduced to small patches. It attains extraordinary development in the orchards situated on the sandy soils of the lower bank of the Jucar (Alcira, Cullera, Sueca, etc.), where its control is a real worry to the farmers, who find difficulty in ridding their trees of this pest. It is found throughout the entire region of the Levant, and its attacks, of varying intensity, extend to other provinces on the coast, where M. beckii lives. There are also important foci in the Balearic Islands.

Table 13 indicates the principal citrus pests in Spanish sweet orange districts in 1943.

Pest Control: The cultural methods in the Spanish citrus industry are well established, and the pest control measures taken were generally of a higher character than those observed either in North Africa or in Italy. In controlling field pests, fumigation is extensively used, and during afternoons in the spring months March and April it is customary to see the high-wheeled springless Spanish carts piled with tents going down the road to an orchard scheduled to be fumigated that night.

Fumigation: During the Civil War, citrus pests were permitted to increase due to the lack of materials and labor to take control measures. Informed pest control people state that prior to the Spanish Civil War it was possible to use a 16 cubic centimeter scale in applying fumigants and obtain a 95 percent kill which usually lasted for 2 years. This situation has now changed, and, even with a heavier dosage such as an 18 to 20 cc. scale which apparently gives a high kill of 99 percent according to available tests, the former long-time control is not obtained. It is necessary to fumigate each year in most groves, and, in cases of heavier infestation, fumigation twice a year is necessary.

Sodium cyanide is in short supply and is likely to continue to be so since it is obtained by the use of foreign exchange. Major supplies in 1948 were obtained from the Netherlands. The cost of fumigation will vary directly in accordance with the source of supply of the cyanide. If it is obtained through official sources, the price will be approximately 6 pesetas a kilo ($0.17 per pound12/) and from unofficial sources 10 to 12 pesetas ($0.28 to $0.33 per pound) a kilo. Due to this factor the cost of fumigation varies greatly. It may be considered that the average cost is approximately 6 pesetas per tree ($0.36), but the range may be all the way from 2½ pesetas ($0.15) to 12 pesetas ($0.73) depending upon size of the tree and source of materials.

12/ Converted at 16.45 pesetas to $1.00.

Table 13.--Spain: Orange zones of the region of Levant and principle scales which constitute plant parasites in each zone.

| Zones | Characteristics of the zones | Species of pest |
|---|---|---|
| I | | |
| Castellon and North part of the province with intermittents to the limit with Tarragona. | Planted to (double-fine) blood oranges and in the north a mixture of varieties. | Chrysomphalus dictyospermi<br>Mytilococcus beckii<br>M. gloverii<br>Coccus oleae<br>Parlatoria pergandei<br>Icerya purchasi<br>Pseudococcus citri |
| II | | |
| Burriana and Villarreal (Castellon) | Planted to tangerines and common oranges with the middle section planted to blood varieties. | Chrysomphalus dictyospermi<br>Mytilococcus beckii<br>M. Gloverii<br>Coccus oleae<br>Ceroplastes sinensis (I)*<br>Icerya purchasi<br>Pseudococcus citri |
| III | | |
| Nules, Vall de Uxo, Onda and Moncofar to Almenara (Castellon) | The low zone is very cold and planted to early white oranges and in the most temperate zone blood varieties predominate. | Chrysomphalus dictyospermi<br>Mytilococcus beckii<br>M. gloverii<br>Parlatoria pergandei<br>Coccus oleae<br>Icerya purchasi<br>Pseudococcus citri |
| IV | | |
| Sagunto, Los Valles, Puzol, Algimia to the zone of Valencia. | The low part is cold in which the early varieties are dominate, and blood varieties are found in the high part of the district. | Chrysomphalus dictyospermi<br>Mytilococcus beckii<br>M. gloverii<br>Coccus oleae<br>Pseudococcus citri<br>Icerya purchasi |

Continued

Continued

| Zones | Characteristics of the zones | Species of pest |
|---|---|---|
| V | | |
| Valencia, Moncada, Betera, Torrente, Albal, to Silla. | Mixture of early varieties. | Chrysomphalus dictyospermi<br>Mytilococcus beckii<br>M. gloverii<br>Parlatoria pergandei<br>Icerya purchasi<br>Pseudococcus citri |
| VI | | |
| Ribera high and low of the Jucar, Carlet, Alberique, Alcira, and Jativa. | The high part of the district is cold and is planted to white oranges, in the temperate low part of the district the typical common orenge and blood varieties are planted. | Chrysomphalus dictyospermi<br>Mytilococcus gloverii<br>I. pinnaeformis<br>Parlatoria zizyphi *<br>P. pergandei<br>Coccus oleae<br>Pseudococcus citri<br>Icerya purchasi |
| VII | | |
| Sueca, Cullera, Tabernes, Gandia, Oliva (Valencia), Pego, Vergel and Denia (Alicante). | Planted to tangerines, common oranges, blood and Verna varieties. The latter is abundant near Oliva and Vergel. | Chrysomphalus dictyospermi<br>Mytilococcus beckii<br>M. gloverii<br>Parlatoria pergandei<br>Pseudococcus citri<br>Icerya purchasi |
| VIII | | |
| Orihuela, Dolores (Alicante), Murcia, Blanca, Ulea, Abaran and Totana (Murcia) | Near Segura the white orange especially the Mecetera is planted, in the higher sections regardless of the cold winters, bloods, Vernas, and lemons are grown | Chrysomphalus dictyospermi<br>Parlatoria pergandei *<br>Mytilococcus gloverii<br>Pseudococcus citri<br>Icerya purchasi |

Underscored print: Important pest in the zone.
* Special pest of the zone.

Source: Cochinillas que atacan a los agrios en la region de Levante, Madrid 1943.

Spraying: Spraying is sometimes used as an auxiliary pest control measure and may be used as a substitute when fumigants are not available. The average cost of spraying is about half that of fumigation and will average from 2 to 6 pesetas ($.12 to $0.36) per tree, including the cost of material and application.

Sprays are applied by power-driven horse-drawn machines, many of which according to United States standards would be considered old fashioned. These machines are generally of small size and narrow wheelbase in order to operate in the closely-planted, small Spanish groves. Since the trees are small, towers are not used. Commercially mixed oil sprays of unknown formula are available, such as "Dr. Trigo." These are said to be mostly oil sulphur mixtures. Another simple formula is used, "Sosa Solvay" as a 1½ percent solution adding some 500 grams of rosin. This is said to be a cheap effective spray which costs only some 50 pesetas per hanegada ($15.38 per acre).

The use of sprays to combat red spider varies in accordance with the district for, like California, pest control problems differ greatly within short distances. Control measures for red spider usually are taken in September and October, and this pest is most prevalent in the region from Valencia to Gandia.

As observed in the Castellon area, pest control problems are neither complicated nor serious. Black scale and purple scale are the two most persistent pests. It is the general practice to fumigate every other year. In some cases it is necessary to do spot spraying with oil emulsions in the intervening period, primarily for purple scale. In orchards visited, scale was under commercial control and no sign of pest damage was seen.

The red spider, which is a pest in many American citrus producing areas, does not seem to be a problem in this citrus district.

The one serious pest over which there is little control is the Mediterranean fruit fly. This pest is active on citrus and soft fruits from June to November. Late in June, the only remaining citrus is off-bloom fruit. While this fruit has a green skin color, it would be salable if it were not for fruit fly damage. It is relatively easy to find infected off-bloom fruit since the fruit colors soon after being perforated by the fly. Cutting infected fruit open, one finds it full of small white maggots, which will eventually emerge from the infested fruit and form flies again to begin the cycle of infestation. The presence of the fruit fly makes it impossible to hold late citrus beyond June, and this pest is also apt to injure the first navels as they ripen in the fall, particularly before the first rains.

In the citrus area there are many host plants for the fly, such as figs, apricots, peaches, cactus plums, and pears.

The only protective measure taken in citrus groves thus far is the placing of little glass fly traps in the tree in an attempt to trap some of the flies and thus reduce the amount of infestation. Some experimentation is being carried on with new sprays. However, there is no effective measure of control in general use. Until the fruit fly hazard is eliminated it would seem that Spain

is prevented from export marketing citrus and soft deciduous fruits during the summer months.

Irrigation

In Spanish citrus districts irrigation is accomplished by the use of both gravity and pumped water. Some of the systems for gravity irrigation were established by the Moors when they occupied Spain. These older systems of irrigation have been supplemented by water supplies obtained from dams in the mountain ranges behind the southern coastal citrus area. The flow of water observed in streams, particularly in the vicinity of Gandia, indicates there are still untapped water supplies for irrigation in Spain.

Even when gravity irrigation water is available to citrus properties, it is often supplemented by pumped water, and large pumping plants are maintained for this purpose. Some of these pumping plants were observed to be very large installations which would certainly cost from 20 to 30 thousand dollars to duplicate. Oil engines were the primary source of power; however, some electric powered pumps are also installed. It is usual that, where electric power is the main source for pumping, the oil engine still is available to furnish power when electric current is not available.

Irrigation water is applied to the groves primarily by flood or flood basin irrigation, and in the lower areas of the La Plana it was observed that sometimes two rows are irrigated at once, there being no separating borders or furrows. It is customary in Spain, as a disease control measure, to create basins around the tree trunks in order to keep that area dry.

The cost of irrigation water varies greatly in Spain. In the low-lands it is relatively inexpensive, but in the better citrus districts such as the Ribera area the cost of irrigation water is very high since the water not only has to be pumped but often has to be elevated to a high location in the grove.

As observed, the practice of irrigation seems to be very competently performed. This is not surprising since Spain has utilized an irrigated agriculture for many generations.

A system of dams is located in the hills behind the coastal plain between Valencia and Castellon, and it furnishes irrigating water to the coastal area. One of these, located approximately 12 kilometers back of Castellon, is called the Pantano de Maria Cristina. This had an original capacity of 26 million cubic meters of water, but a recent weakness occurring near one of the dam anchorages made necessary the lowering of the overflow gates, thus reducing the capacity to approximately 20 million cubic meters of water. A new dam being constructed some distance south on the Rio Mijares will impound 45 million cubic meters of water. This dam will be known as the Pantano "Sichar." It is planned to link these two dams by a canal, so that the overflow from the Pantano Sichar will be diverted to the Pantano de Maria Cristina. As a part of the completion of this project, it is planned to raise the overflow gates on the Pantano de Maria Cristina and to raise the dam, thereby increasing the capacity to 50 million cubic meters. Completion of this project may be expected in approximately 10 years.

Water is carried by open cement ditches, being distributed to each holder of water rights. At the point of distribution tiled markers are placed in the irrigation ditches in order that the flow of water may be accurately measured. During years of normal rainfall, gravity water is available to most groves throughout the year. However, there are auxiliary systems of irrigation by means of pumped water. This pumped water is fed into the regular irrigation distributing system.

Fertilization

In the 1948-49 season the Government allotment in the Castellon area was for the equivalent of 12 kilos of sulphate of ammonia per hanegada. Part of nitrogenous fertilizer was available as sulphate of ammonia and part of nitrogenous fertilizer was available as sulphate of ammonia and part as nitrate of lime. It was the opinion of growers that this allotment might be increased slightly for the 1949-50 season, possibly to the equivalent of 18 kilos per hanegada.

Sulphate of ammonia obtained at regular prices under Government regulation costs 1.95 pesetas per kilo($.05 per pound). Sulphate of ammonia purchased on the black market may cost from 10 to 12 pesetas per kilo($.28 to $.33 per pound.) It is the opinion of growers that they should be able to apply at least 50 kilos of sulphate of ammonia per hanegada (558 pounds per acre), but if adequate supplies of fertilizer were available, they might apply as much as 100 kilos (1,115 pounds per acre). (See Table 14.)

A shortage of nitrogenous fertilizers exists in Spain, but since it is necessary to purchase this item by foreign exchange it seems unlikely that abundant supplies will be available in the next 5 years.

In the early 1930's, when Spain was producing its very large citrus crops, it was the practice of growers to fertilize very heavily. This was carried to such an extent that it is said that the fertilizing elements could be tasted in the fruit, and the quality of the products both for shipping and eating was much reduced, resulting in marketing difficulties at that time. From discussions with growers, it is the author's opinion that they would again carry fertilization to excess if they were given an opportunity.

Spain has never been able to rebuild her herds of domestic animals which were seriously depleted during the Civil War. Therefore, there still remains a shortage of manures for use in orchard fertilization.

Table 14 - Spain: Mineral fertilizers required for citrus 1/

| | Kilos per hanegada | Pounds per acre |
|---|---|---|
| Superphosphate of lime | 45 | 502 |
| Sulphate of ammonia | 35 | 390 |
| Potassium (sulphate) | 15 | 167 |
| Sulphate of iron | 5 | 56 |

1/ La Riqueza Citricola Espanola, by Luis Rosen Perez, page 44.

Frost Protection

No frost protection is practiced in Spanish groves, although some of the districts frequently experience damaging cold weather. In the colder citrus areas the plantings were observed to be planned so that tangerines are grown in the coldest areas. Since this crop in usually harvested before the first of the year the fruit is usually off the tree before the damaging frost occurs.

The higher areas of the Ribera and the coastal area of the Marina near Gandia are usually free from tree damaging frost.

Near Castellon an interesting practice for protection against hail was seen. Rockets approximately 3 feet long and 2½ inches in diameter with aluminum tips and wooden fins are fired into possible hail-forming clouds. By this means, the growers hope to break up the clouds so that the damaging hail will not fall on the adjacent citrus orchards.

## SPANISH DEPARTMENT OF AGRICULTURE

The Department of Agriculture operates a citrus experiment station at Burjasot near Valencia. There a small orchard is planted to several varieties. However, the main activity of the station is not in experimentation and cultural practice but rather with scientific investigation. An entomology laboratory is maintained together with a large laboratory for the production of crypt for distribution to Spanish mealy bug infested areas. This operation is rather small for commercial operation.

One of the most interesting laboratories is the one in which experimentation is carried on with the processing of citrus fruits. In this plant experiments are made with different varieties of oranges and different canning methods. Samples were tasted, and there is a marked difference of taste between the comuna, verna, and the Valencia late. Experimentation is also being carried on with other fruit, such as the canning of strawberry juices. Investigation of the extraction and processing of essences and the study of the vitamin characteristics of juices is a part of the work. Studies of soil and citrus diseases such as psorosis are being made. The Spanish Department of Agriculture and the experiment station issue publications from time to time as investigations are completed. Due to the many very small agricultural holdings, the Department of Agriculture has a very great problem in presenting information to growers, a considerable percentage of whom may be illiterate or semi-illiterate.

# MARKETING

## Domestic Consumption of Citrus

The domestic consumption of citrus in Spain has been greatly increased during the past 15 years. Prior to the Spanish Civil War in 1936, it is stated that little citrus could be found in markets except in the southern coastal producing areas. The entire emphasis during this period was toward export, and little or no attention was given to the home market. The Civil War disrupted exports and created interest in new market outlets. Also, the war brought many people into citrus producing areas, where they had an opportunity to become consumers for the first time.

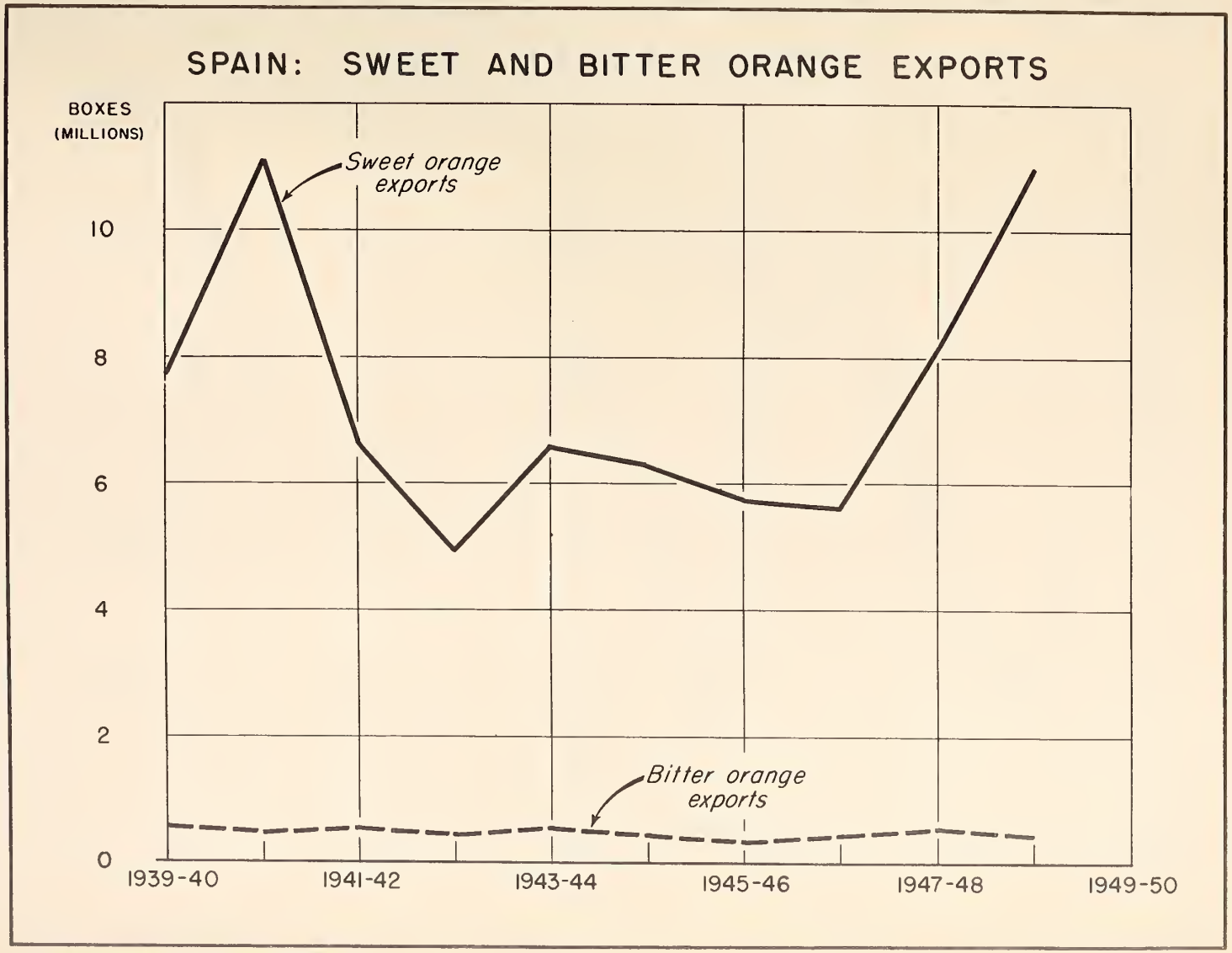
Immediately upon the termination of the Spanish civil strife, World War II further disrupted export markets, and the interest in domestic sales was continued. (Also, during the World War, the shortage of rail transport created a new interest in processed fruit.)

The following would seem to be a reasonable estimation of this trend in domestic consumption including fruit used for processing. 1/

| | Kilograms | Boxes |
|---|---|---|
| 1928-29 | 35,000,000 | 1,102,300 |
| 1931-32 | 56,000,000 | 1,763,680 |
| 1933-34 | 48,000,000 | 1,511,726 |
| 1934-35 | 95,129,235 | 2,996,028 |
| 1935-36 | 60,000,000 | 1,889,657 |
| 1939-40 | 236,000,000 | 7,432,652 |
| 1940-41 | 239,930,000 | 7,556,425 |
| 1942-43 | 284,161,723 | 8,949,472 |
| 1943-44 | 222,800,000 | 7,016,928 |
| 1944-45 | 311,450,968 | 9,808,927 |
| 1945-46 | 208,033,839 | 6,551,878 |
| 1946-47 | 194,821,344 | 6,135,760 |
| 1947-48 | 242,494,707 | 7,637,199 |

The fruit consumed domestically consists primarily of oranges of non-exportable grades. In domestic sales, varieties are not segregated, and fruit for sale may be a mixture of several varieties of various qualities, such as comuna, bloods, and Valencia lates. Lemons are also sold ungraded in bulk and consist of various sizes and maturities. It is common to see green lemons of approximately American commercial size mixed with very large mature fruit 3 inches or more in diameter and over 4 inches in length. This large fruit has a very thick skin, but it is most representative of lemons seen in fruit stands. The major centers of domestic consumption are in the coastal producing areas of the Levant, including Valencia and Castellon, and at Murcia and Malaga. The other two major centers of consumption are the metropolitan centers of Madrid and Barcelona, which have slightly over 1 million population each. In these areas the per capita consumption is much higher than in the rest of Spain, where there are still many villages in which citrus is seldom found.

1/ La Riqueza Citricola Espanola, Datos y Reflexiones sobre la Economia de la Naranja y demas Frutas Citricas, by Luis Roson Perez, Madrid 1948, page 121.




U. S DEPARTMENT OF AGRICULTURE

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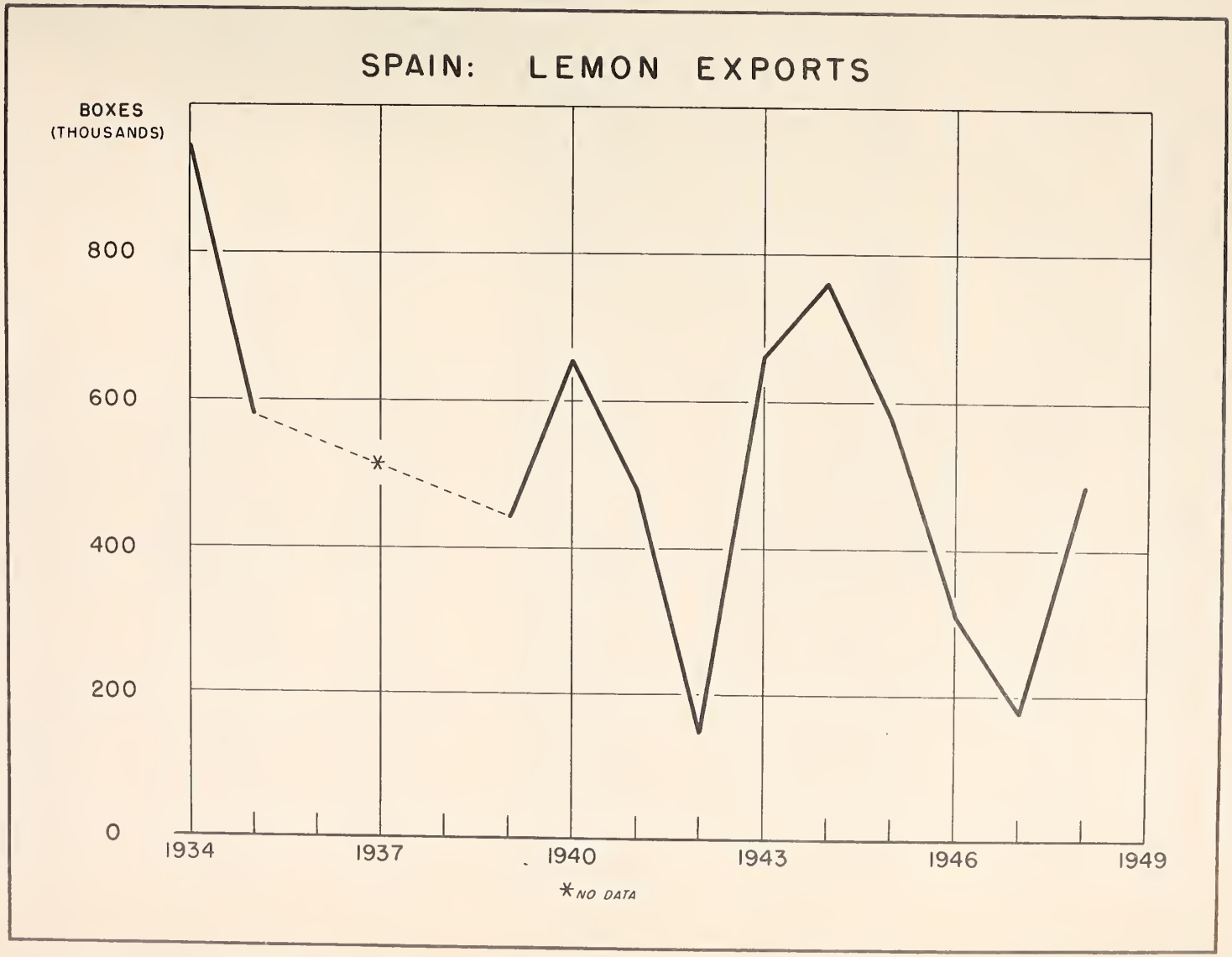


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Citrus is consumed domestically primarily as fresh fruit. However, citrus drinks are sold in metropolitan areas. The majority of the raw material for such beverages is single-strength juice. Recently, a new factory in southern Spain has been completed and is processing juice by United States standards with United States machinery. These products are being advertized and sold domestically. This merchandizing will undoubtedly result in an increased domestic consumption of both single-strength and concentrated orange juice.

The retail price of oranges varies from as low as 2 pesetas per kilo ($0.06 per pound) at the height of the season to approximately 4 pesetas a kilo ($0.11 per pound) during times of short supply. In cafes, 6 ounces of reconstituted concentrated orange juice sell for 3 pesetas ($0.08).

Domestic Prices of Spanish Citrus, November 1949 14/

Sweet Oranges and Tangerines. Domestic prices were slightly higher than those prevailing in October 1948. Sweet oranges were priced at 10.00 to 12.00 Spanish pesetas ($.99 to $1.19) per arroba. 15/ In this category prices were identical to the 1948-1949 season. Tangerines were selling from 16.00 to 18.00 pesetas ($1.59 to $1.79) per arroba, or an average of 1 peseta more per arroba than in the corresponding season of the preceding year. Seedless tangerines are worth 33.00 to 35.00 pesetas ($3.28 to $3.48) per arroba, which represents an average increase of 4 pesetas over prices quoted in autumn 1948.

Lemons. The price of lemons in this region in November 1949 ranged from 11.00 to 12.00 pesetas ($1.19 to $1.29) per arroba on the trees. Corresponding prices the preceding year were between 11.00 and 14.00 pesetas ($1.19 and $1.51). In the Malaga region lemon prices registered the highest increment, as dealers reported receiving offers exceeding 150 pesetas ($6.00) per 1,000 lemons on trees as compared to 25.00 to 40.00 pesetas ($1.00 to $1.60) in October 1948.

Picking

In Spain the picking of citrus fruits may be performed by men, women, and children. It is customary that the fruit be clip-picked from the tree, utilizing a tool similar to a small wire cutter. No picking baskets are used, the fruit being placed by hand in either baskets or boxes.

In various citrus localities the terminology applied to picking containers differs. For example, a common unit for measuring fruit picked from the tree is the arroba. In the vicinity of Castellon it means a measure of 13 kilos. In the vicinity of Valencia it is a measure of 12 kilos. For statistical purposes the arroba is usually considered to consist of 12½ kilos.

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14/Source: Despatch No. 16 from American Consul at Valencia dated November 5, 1949.

15/1 Arroba is equal to 12,780 kilograms.

How Citrus Fruits Are Sold by the Grower

There are several accepted procedures for selling fruit. Early in the season fruit buyers may purchase an entire crop for a lump sum price. However, the usual procedure is to purchase the fruit either by weight or count on the tree. The fruit buyer furnishes all the labor for picking. Picking practice is to clip the fruit and place it in a basket; the baskets are carried by hand to a central location in the grove where the fruit is dumped on the ground usually in a layer of straw. From such a pile the fruit is either counted by thousands or weighed into boxes or arrobas and carried by cart or truck to the packing house. Fruit piled in the orchard may be left there for a day or two before it is so counted or hauled.

While most fruit in Spain is handled through fruit buyers, there are a few cooperative enterprises. The Spanish citrus grower is usually highly individualistic, and, therefore, the growth of this type of organization has been slow. Other factors which have retarded the development of cooperatives are the generally high level of illiteracy in Spain and also the very small orchard holdings. In order to bring together sufficient acreage to operate a citrus packing house, it would require a meeting of the mind of perhaps a thousand growers.

Packing

All types of citrus packing houses were observed in Spain, beginning with the very simple structure where most processes are carried out by hand with the fruit being stored in bulk in piles on the floor and no graders or washers being used. From observation, however, it would be the author's estimate that at present the majority of the fruit in Spain is packed in semi-modern packing plants containing washers and often waxers, or at least a machine where the fruit is polished with the use of sawdust, and sizers and graders. The majority of this equipment is manufactured in the vicinity of Valencia.

In the packing house the fruit is prepared in several ways according to the market to which it is to be shipped. All oranges shipped to the United Kingdom and western European markets other than France are wrapped and packed in two-compartment boxes. This is a flat, non-bulge pack, and would be considered a loose pack by California standards. However, the non-bulge package is very easy to handle in sea shipment.

The oranges sold to France are primarily shipped in bulk, either by rail cars or by boat, from a Spanish port such as Valencia to a Mediterranean coastal port such as Port Vendres. Since the Spanish rail gauge is wider than the standard European gauge, rail shipments must be transferred to different cars at the French-Spanish border. This is true of both boxed and bulk fruit. When the bulk shipments are made by boat the fruit is usually carried to the Spanish ports by truck, and the baskets of fruit are slid down an inclined plane to the hold of the ship where the fruit is dumped. The empty baskets are carried back to the truck and returned to the packing house. At the French port the fruit is placed in baskets in the ship's hold and carried up by hand to be dumped into rail cars.

In winter these rail cars are protected with both straw and paper on the sides, and, if the weather is cold, straw and paper are placed over the fruit. The fruit is piled in the cars from 4 to 5 feet deep.

The fruit prepared for bulk shipment is usually of a mixed grade. From observation it is the author's opinion that this fruit is the residual payment on the fruit in the packing house, the better grades being left and packed for United Kingdom and other western European markets. In the bulk shipments of fruit to France, half of the oranges are wrapped, and half are unwrapped. It is amazing to see this fruit being unloaded in Paris with the wrappers still intact. This wrap is twisted at each end, and the paper is very tight to the orange when unloaded, even though the fruit has been handled at least twice in bulk.

Transportation

The transportation in Spanish citrus districts is not as satisfactory as it should be. The primary means of transport of fruit from the orchard to the packing house is the springless two-wheel cart, which often gives the fruit very rough treatment in travel over the very rough Spanish roads. While the main highways in Spain are usually of excellent construction, some of the side roads in rural areas are not paved. For export fruit the transportation from the packing house to the port might be either by motor truck or by horse-drawn carts. The bulk of the fruit is handled with horse-drawn vehicles because of the expense of automotive transportation due to the high cost of trucks in pesetas. In the vicinity of Valencia, however, small railroads of narrow gauge usually operate from the packing house to the ports.

As was mentioned above, the Spanish main line railroad gauge is wider than the European gauge, and it is necessary to transfer all freight at the French-Spanish border, incurring extra handling charges.

The problem of local transportation is one of the factors which will hinder the development of a large orange processing industry in Spain.

In the accompanying schedules of sea and rail freight rates (tables 15-17) the dollar cost should be noted. In the sea freight rates it will be noted the cost for a standard 35-kilo box is approximately 49 cents. Freight rates per ton for shipment to French Mediterranean ports and to the Spanish border are also given with dollar equivalents. It will be noted that, in the combined sea and rail freight rates for shipment of fruit from Valencia to Paris, the alternate freight rate will depend upon the size of rail car which is used for the French part of the journey.

These freight rates have been converted at 16.45 to the dollar, which is the official exchange rate for sweet oranges. It should be kept in mind, however, that the free rate of exchange for the peseta at Tangiers at that time was approximately 40 pesetas to the dollar. If the free rate of exchange for the peseta were used, the freight rates which apply to the Spanish part of the journey would be approximately one-half to one-third the rates given.

On the basis of the free rate of exchange for the peseta, the freight rate paid by the Spanish citrus grower to get his fruit to market is considerably lower than that paid by the French citrus grower in North Africa.

Table 15.--Spain: Sea freight rates for citrus fruits per box to Mediterranean and channel ports

| Port of origin | Port of destination | Per standard box 35 kilos gross weight 30 kilos net | | |
|---|---|---|---|---|
| | | Foreign currency | | Dollars |
| Valencia | Port Vendres or Marseille | 8 pesetas | 2/ | .49 |
| Valencia 1/ | Liverpool | 3 shillings 6 pence | | .49 |
| Valencia 1/ | Antwerp | 3 shillings 6 pence | | .49 |

1/ On some shipments it is common practice to rebate 3 pence per box to shippers although the charge on the bill of lading is 3 shillings 6 pence.

2/ Converted at 16.45 pesetas to $1.00.

Table 16.—Spain: Freight rates for citrus fruits from Spanish producing districts to Paris, March 1950

Rail Freight Rates:

| Port of Origin | Destination | Rate per metric ton: Foreign Currency | Rate per metric ton: United States currency |
|---|---|---|---|
| Valencia | Cerbere | 1/ 225 pesetas | 13.67 |
| Cerbere | Paris | 2/ 3,500 French francs | 10.02 |
| Total: Valencia to Paris | | | |
| Dollars per metric ton | | | 23.69 |
| Dollars per box | | | .75 |

Table 17.—Spain: Freight rates for combined sea and rail shipment of citrus from Spanish ports to Paris

| Port of Origin | Destination | Rate per metric ton: Foreign Currency | Rate per metric ton: United States currency |
|---|---|---|---|
| Sea Freight Rates (Bulk shipments): | | | |
| Valencia | Port Vendres or Marseille | 150 pesetas to 175 pesetas | 9.12 to 10.64 |
| Rail Freight Rates (Bulk shipments): | | | |
| Port Vendres | Paris (3 ton car) | 8,119 French francs | 23.24 |
| | (5 ton car) | 5,867 | 16.80 |
| | (8 ton car) | 5,308 | 15.20 |
| Marseille | Paris (3 ton car) | 7,493 | 21.45 |
| | (5 ton car) | 5,414 | 15.50 |
| | (8 ton car) | 4,898 | 14.02 |

Total sea and rail freight rates Valencia to Paris via Port Vendres: (Bulk shipments).

Sea freight rates: Valencia to Port Vendres------$9.12 to $10.64 per metric ton

Total rail and sea rates via Port Vendres, Valencia to Paris:

| | | |
|---|---|---|
| 3 ton car | per metric ton | $32.36 to $33.88 |
| | per box | 1.03 to 1.08 |
| 5 ton car | per metric ton | 25.92 to 27.44 |
| | per box | .82 to .87 |
| 8 ton car | per metric ton | 24.32 to 25.84 |
| | per box | .77 to .82 |

(Continued on following page)

1/ Peseta converted at 16.45 to $1.00.
2/ Franc converted at 349 to $1.00.

| | | |
|---|---|---|
| Total rail and sea rates via Marseille, Valencia to Paris: | | |
| 3 ton car | per metric ton | $30.57 to $32.09 |
| | per box | .97 to 1.02 |
| 5 ton car | per metric ton | 24.62 to 26.14 |
| | per box | .78 to .83 |
| 8 ton car | per metric ton | 23.14 to 24.66 |
| | per box | .74 to .78 |

Furnished by the American Consul at Valencia, Spain, and the Office of the Agricultural Attache, American Embassy in Paris.

Table 18.—Spain: F.o.b. prices of Spanish oranges reported by the National Syndicate of oranges 1/

| Variety | 1939-40 Pesetas per kilo | 1940-41 Pesetas per kilo |
|---|---|---|
| Comuna | .30 to .40 | .60 to .70 |
| Navel | .60 to .70 | .90 to 1.00 |
| Cadenera | .50 to .60 | .80 to .95 |
| Tangerines | .30 to .40 | .70 |
| "Redonda" | .40 | .70 |
| Entrefina (Blood) | .40 to .50 | .60 to .70 |
| Doble-fina (Blood) | .50 to .60 | .80 to .90 |
| Verna (non-blood) | .80 | 1.00 to 1.25 |

1/. La Riqueza Citricola Espanola by Luis Roson Perez, page 51.

The Cost of Harvesting and Packing

Below is given the actual cost of one operator in picking, packing, and shipping a 30-kilo, 2-compartment California box of oranges:

| | Pesetas | Dollars 1/ |
|---|---|---|
| 30-kilo 2 compartment box | 6.50 | 0.395 |
| Nails | 0.70 | .042 |
| Binding twine (substitute for wire) | 0.40 | .024 |
| Labels | 0.10 | .006 |
| Paper wrappers | 3.00 | .182 |
| Power and light | .05 | .003 |
| Picking | 1.55 | .094 |
| Cartage grove to warehouse | 1.15 | .070 |
| Packing in warehouse | 1.95 | .119 |
| Carpenters for making boxes | 0.65 | .039 |
| Cartage warehouse to port (2 miles from port) | 0.85 | .052 |
| Loading charges on steamers | 0.90 | .055 |
| Insurance, social, etc | 0.40 | .024 |
| General overhead | 1.65 | .100 |
| Syndicate | 0.60 | .036 |
| Total | 20.45 | 1.241 |

1/ Converted at the rate of 16.45 pesetas to the dollar.

The cost of cartage of port of .85 (5 cents) is calculated on the basis of truck transportation. Many of the Spanish shipping ports, such as Gandia, Burriana, and Castellon, are served by narrow gauge railway on which transportation is much cheaper. In this case, for example, rail transportation is 20 centavos a box. The costs indicated above should be considered low and as a minimum since this operation is located near the coast. In other areas of Valencia, further removed from the sea, the cost would be at least 1 to 1½ pesetas (6 cents to 9 cents) greater per box, making a total of from 21.45 to 21.95 ($1.30 to $1.33). In areas such as Murcia, where there is a considerable haul to the coast, a similarly greater cost will be incurred.

In the packing house of the above tabulation, the cost of packing the same box in 1935-36 was 7.30 pesetas (44 cents). An analysis of the cost items indicates that the increase is due primarily to the higher prices of purchased materials such as shooks, wrappers, and nails. Wages showed an advance of only 20 percent.

In considering the cost of preparing fruit for market, we must realize that only a portion of the crop is packed in boxes, and that a large proportion of some 200,000 tons is probably sold in the domestic market in bulk and also that the fruit shipped to France is shipped in bulk.

Taking the same cost figures and using them for the basis of preparing a bulk shipment, the following costs would be involved for 30 kilos of fruit:

| | Pesetas | Dollars |
|---|---|---|
| Paper wrappers (Approximately one-half of the fruit in bulk shipment has been observed to be wrapped) | 1.50 | 0.091 |
| Power and Light | .05 | .003 |
| Picking | 1.55 | .094 |
| Cartage grove to warehouse | 1.15 | .070 |
| Packing at the warehouse (wrapping) (Computed at ½ the cost of packing) | 1.00 | .061 |
| Cartage warehouse to port | .85 | .052 |
| Loading charges at steamer | .90 | .055 |
| Social insurance | .40 | .024 |
| General overhead | 1.65 | .100 |
| Syndicate | .60 | .037 |
| Total | 9.65 | .587 |

The range of cost of preparing fruit for market may, therefore, be computed as follows and the handling of the majority of fruit from Spain should fall within these brackets: For a 30 kilo 2-compartment California box, cost from picking to f.o.b. port, from 20.45 to 25.00 pesetas ($1.24 to $1.52). For the preparation of 30 kilos of fruit for export in bulk, from 9.65 to 12.00 pesetas ($0.59 to $0.73).

The price relationships of the several Spanish citrus varieties is indicated by the following table:

Table 19.--Spain: Comparison of citrus packing costs, 1939/40-1945/46

| Season | Nails | Lumber | Paper | Cord | Wages | Various costs | Taxes | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Pesetas | Dollars |
| 1939-40 | 0.274 | 3.50 | 1.12 | 0.40 | 3.393 | 3.273 | 1.1135 | 13.0735 | .79 |
| 1940-41 | 0.30 | 4.00 | 2.15 | 0.40 | 4.05 | 3.52 | 1.45 | 15.87 | .96 |
| 1944-45 | 1.00 | 6.50 | 2.78 | 0.60 | 4.70 | 5.85 | 3.35 | 24.78 | 1.51 |
| 1945-46 | 1.00 | 6.60 | 2.75 | 0.85 | 4.70 | 5.85 | 3.50 | 25.15 | 1.53 |

## Export Marketing

Citrus has long been an important export crop in Spain, and in 1948-49 10,983,760 boxes of sweet oranges and tangerines were exported. For many years Spain has been the primary supplier of oranges to western Europe.

The accompanying tabulation of exports, by months, of oranges and lemons for 1947-48 will indicate the seasonality of Spanish citrus exports. For oranges the season begins in November with tangerines, followed in December by the navel orange and by white oranges, which include the comuna, a seeded non-blood orange and the Cadenera, a seedless non-blood orange of approximately the same season as the navel. Some of the white oranges continue in the market in March and April, but these months are devoted primarily to the shipment of blood oranges. In May and June the primary variety is a late non-blood orange called the Verna or Berna. This is an oval-shaped orange, and Spanish citrus growers consider it superior to the Valencia late, which is similar to our Valencia. The Spanish late orange acreage, however, is primarily of the verna variety, the Valencia late being a minor variety only.

The Spanish citrus industry is primarily a winter orange producing district, and shipping is heaviest from December through April. It is possible that the late varieties might be held on the tree after May; however, there is little incentive to do this since the May prices are usually excellent, and the longer the fruit is held on the tree the greater the danger of its dropping and of pilferage. Also, it might be subject to damage by the Mediterranean fruit fly.

Examining the seasonality of lemon exports, one will note that Spain is primarily an exporter of summer lemons. There are two reasons for this: the first is the heavy competition Italy offers in European markets during the winter months, and the second factor is the varieties of lemons raised in Spain near Murcia. The most important lemon is a so-called late variety, and, like the orange, is called a berna. The heaviest exports of lemons from Spain are from May to September; this is not shipment of stored fruit, since no facitities for storage exist and the fruit is fresh picked from the trees.

This Spanish late maturing lemon may possibly be of some interest as a commercial variety for our lemon districts.

Table 20.—Oranges, sweet and bitter: Exports from Spain by country of destination, crop year 1939-48

| Country of destination | 1939-40 | 1940-41 | 1941-42 | 1942-43 | 1943-44 | 1944-45 | 1945-46 | 1946-47 | 1947-48 | 1948-49 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons |
| | | | | Oranges, sweet | | | | | | |
| Great Britain | 118,236 | 19,058 | 23,520 | --- | 108,871 | 181,770 | 94,452 | 81,018 | 119,859 | 86,000 |
| France | 63,863 | 13,662 | 28,332 | --- | 17 | --- | 298 | --- | 2,357 | 124,601 |
| Netherlands | 17,036 | 245 | 2,048 | 4,851 | 7,432 | --- | 6,755 | 28,528 | 31,221 | 26,603 |
| Belgium | 16,683 | --- | 865 | 1,576 | 2,911 | --- | 5,613 | 36,637 | 32,323 | 36,240 |
| Norway | 11,443 | 1,808 | 740 | 1,240 | 1,170 | --- | 7,554 | --- | 9,787 | 5,818 |
| Switzerland | 8,709 | 7,543 | 6,497 | 22,284 | 18,530 | --- | 22,423 | --- | 16,456 | 10,527 |
| Sweden | 5,966 | 1,280 | 3,338 | 13,226 | 34,732 | 7,298 | 37,339 | 27,525 | 30,507 | 24,970 |
| Denmark | 1,853 | --- | 1,774 | 1,265 | 2,240 | --- | 6,885 | 110 | 1,980 | 8,276 |
| Ireland | 921 | 1,148 | 1,372 | 1,757 | 370 | --- | 2,111 | 5,274 | 540 | 929 |
| Argentina | --- | --- | --- | --- | --- | --- | --- | 195 | 5,184 | 2,536 |
| Finland | --- | --- | 350 | --- | --- | --- | --- | --- | 137 | 4,328 |
| Germany | --- | 309,051 | 141,769 | 110,100 | 32,040 | --- | --- | --- | 9,671 | 17,500 |
| Others | 32 | 0 | 425 | 669 | 609 | 10,002 | 0 | 72 | 141 | 426 |
| Total | 244,742 | 353,795 | 211,030 | 156,968 | 208,922 | 199,070 | 183,430 | 179,359 | 260,163 | 348,754 |
| | | | | Oranges, bitter 1/ | | | | | | |
| Total | 18,963 | 15,289 | 17,067 | 13,375 | 17,735 | 14,801 | 10,622 | 13,750 | 17,380 | 13,433 |
| | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes |
| | | | | Oranges, sweet | | | | | | |
| Great Britain | 3,723,759 | 600,218 | 740,746 | --- | 3,428,815 | 5,724,717 | 2,974,699 | 2,551,604 | 3,774,874 | 2,708,509 |
| France | 2,011,320 | 430,275 | 892,296 | --- | 535 | --- | 9,385 | --- | 74,232 | 3,924,220 |
| Netherlands | 536,537 | 7,716 | 64,500 | 152,779 | 234,066 | --- | 212,744 | 898,469 | 983,283 | 837,843 |
| Belgium | 525,419 | --- | 27,243 | 49,635 | 91,680 | --- | 176,777 | 1,153,856 | 1,017,990 | 1,141,353 |
| Norway | 360,389 | 56,942 | 23,306 | 39,053 | 36,848 | --- | 237,908 | --- | 308,235 | 183,234 |
| Switzerland | 274,284 | 237,561 | 204,618 | 701,819 | 583,589 | --- | 706,197 | --- | 518,270 | 331,540 |
| Sweden | 187,895 | 40,313 | 105,128 | 416,543 | 1,093,850 | 229,845 | 1,175,965 | 866,880 | 960,796 | 786,412 |
| Denmark | 58,359 | --- | 55,871 | 39,840 | 70,547 | --- | 216,838 | 3,464 | 62,359 | 260,647 |
| Ireland | 29,006 | 36,155 | 43,210 | 55,335 | 11,653 | --- | 66,485 | 166,101 | 17,007 | 29,258 |
| Argentina | --- | --- | --- | --- | --- | --- | --- | 6,141 | 163,266 | 79,870 |
| Finland | --- | --- | 11,023 | --- | --- | --- | --- | --- | 4,315 | 136,307 |
| Germany | --- | 9,733,342 | 4,464,914 | 3,467,521 | 1,009,077 | --- | --- | --- | 304,581 | 551,150 |
| Others | 1,008 | 0 | 13,385 | 21,071 | 19,180 | 315,006 | --- | 2,269 | 4,441 | 13,417 |
| Total | 7,707,976 | 11,142,522 | 6,646,240 | 4,943,596 | 6,579,850 | 6,269,568 | 5,776,998 | 5,648,784 | 8,193,649 | 10,983,760 |
| | | | | Oranges, bitter 1/ | | | | | | |
| Total | 597,226 | 481,516 | 537,513 | 421,236 | 558,551 | 466,147 | 334,532 | 433,046 | 547,371 | 423,063 |

1/ Country of destination not available.

Table 21.—Lemons: Exports from Spain, by country of destination, 1934-48

| Country of destination | 1934 | 1935 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons | Metric tons |
| Germany | 5,542 | 2,269 | 5,597 | 2,278 | 15,365 | 15,909 | --- | --- | --- | 19 | 1,200 | 2,600 |
| Algeria | 364 | 120 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Belgium | 1,229 | 431 | --- | 668 | 840 | 982 | 933 | 850 | 1,984 | 901 | --- | 100 |
| France | 8,909 | 6,470 | 1,697 | 187 | 2 | 1,248 | 1,212 | 2 | --- | 5,041 | --- | 7,300 |
| Great Britain | 13,531 | 9,091 | 7,921 | --- | --- | --- | 1,368 | 74 | --- | 8 | 12,400 | 10,700 |
| The Netherlands | 791 | 250 | --- | --- | 383 | 1,168 | 565 | 830 | 90 | 562 | --- | --- |
| Spanish Morocco | 516 | 232 | 56 | 46 | 200 | 125 | 28 | 121 | 40 | 51 | --- | --- |
| Norway | 59 | 27 | --- | --- | --- | --- | 601 | 30 | --- | 42 | --- | --- |
| Sweden | 133 | 191 | --- | --- | 1,116 | 1,759 | 2,253 | 1,955 | 1,682 | 2,842 | --- | --- |
| Switzerland | 311 | 472 | 268 | 833 | 3,004 | 3,090 | 4,787 | 2,736 | 438 | 4,128 | --- | 200 |
| Denmark | 330 | 112 | 45 | 513 | 1,013 | 559 | 1,056 | 2,930 | 826 | 2,129 | --- | --- |
| Ireland | 33 | 35 | 330 | 435 | 282 | 142 | 987 | 602 | 29 | 194 | --- | --- |
| Spanish possessions 1/ | 238 | 253 | 472 | 157 | 290 | 446 | 451 | 536 | 916 | 611 | --- | --- |
| Others | 376 | 117 | 133 | 1 | 277 | 2/ 863 | 3/ 5,646 | 51 | 87 | 181 | 1,700 | 1,708 |
| Total | 32,362 | 20,070 | 16,519 | 5,118 | 22,772 | 26,291 | 19,887 | 10,717 | 6,092 | 16,709 | 15,300 | 22,608 |
| | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes |
| Germany | 160,762 | 65,819 | 162,357 | 66,080 | 445,706 | 461,487 | --- | --- | --- | 551 | 34,809 | 75,421 |
| Algeria | 10,559 | 3,481 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Belgium | 35,651 | 12,502 | --- | 19,377 | 24,367 | 28,486 | 27,064 | 24,657 | 57,552 | 26,136 | --- | 2,900 |
| France | 258,431 | 187,681 | 49,226 | 5,424 | 58 | 36,202 | 35,158 | 58 | --- | 146,229 | --- | 211,757 |
| Great Britain | 392,506 | 263,711 | 229,771 | --- | --- | --- | 39,683 | 2,147 | --- | 232 | 359,698 | 310,384 |
| The Netherlands | 22,945 | 7,252 | --- | --- | 11,110 | 33,881 | 16,389 | 24,077 | 2,611 | 16,302 | --- | --- |
| Spanish Morocco | 14,368 | 6,730 | 1,624 | 1,334 | 5,802 | 3,626 | 812 | 3,510 | 1,160 | 1,479 | --- | --- |
| Norway | 1,711 | 783 | --- | --- | --- | --- | 17,434 | 870 | --- | 1,218 | --- | --- |
| Sweden | 3,858 | 5,541 | --- | --- | 32,373 | 51,025 | 65,355 | 56,710 | 48,791 | 82,440 | --- | --- |
| Switzerland | 9,021 | 13,692 | 7,774 | 24,164 | 87,140 | 89,634 | 138,861 | 79,366 | 12,705 | 119,745 | --- | 5,801 |
| Denmark | 9,573 | 3,249 | 1,305 | 14,881 | 29,385 | 16,215 | 30,632 | 84,993 | 23,961 | 61,758 | --- | --- |
| Ireland | 957 | 1,015 | 9,573 | 12,618 | 8,180 | 4,119 | 28,631 | 17,463 | 841 | 5,628 | --- | --- |
| Spanish possessions 1/ | 6,904 | 7,339 | 13,692 | 4,554 | 8,412 | 12,938 | 13,083 | 15,548 | 26,571 | 17,724 | --- | --- |
| Others | 10,907 | 3,393 | 3,859 | 30 | 8,035 | 25,033 | 163,778 | 1,479 | 2,524 | 5,251 | 49,314 | 49,547 |
| Total | 938,753 | 582,188 | 479,181 | 148,462 | 660,568 | 762,646 | 576,880 | 310,878 | 176,716 | 484,693 | 443,821 | 655,810 |

1/ Canary Islands, Ceuta, Melilla and Andorra.
2/ Includes 5,532 metric tons to the United States.
3/ Includes 226 metric tons to Rumania and 534 metric tons to Czechoslovakia.

Table 22. - Citrus exports from Spain by months, 1947 and 1948.

| Month | Oranges | | Lemons | |
|---|---|---|---|---|
| | 1947 | 1948 | 1947 | 1948 |
| | Boxes | Boxes | Boxes | Boxes |
| January | 1,154,643 | 649,948 | 3,278 | 928 |
| February | 538,332 | 1,791,332 | 1,131 | 1,015 |
| March | 752,776 | 1,039,973 | 11,777 | 15,722 |
| April | 1,247,710 | 1,804,717 | 27,151 | 21,814 |
| May | 249,403 | 947,317 | 19,406 | 56,798 |
| June | 55,871 | 167,140 | 46,761 | 42,033 |
| July | 17,605 | 22,991 | 14,823 | 157,542 |
| August | 378 | 724 | 27,006 | 59,205 |
| September | 63 | --- | 13,837 | 27,557 |
| October | 252 | --- | 2,814 | 47,486 |
| November | 548,977 | 224,271 | 3,278 | 16,709 |
| December | 815,923 | 1,851,770 | 2,640 | 30,168 |
| Total | 5,381,933 | 8,500,183 | 173,902 | 476,977 |

Source: Intelligence Bulletin, May 1949.

## Trade Agreements

### How Spain Sells Her Citrus

In the postwar period, Spain has resorted to several devices in order to carry on her foreign trade. Spain has the double problem of finding markets for her exports, which are largely raw materials and agricultural products, and at the same time diverting the earned foreign exchange into channels which will lead to the import of essential commodities. In order to accomplish these ends shortly after the end of World War II, three plans were put into effect. First, subsidies were paid to certain exports from money earned by the import of certain other commodities. A second plan was to import raw materials and subsequently export a percentage of the same commodity in a manufactured form, thus compensating for the import of the commodity. A third plan permitted exporters of merchandise to purchase a percentage of the sterling proceeds of their exports to be used for the importation of things needed by them in connection with their business. In addition to these foreign trade devices, the Spanish Government later found it necessary to modify its foreign exchange rates. Without the peseta being devalued, a system of multiple exchange rates was established for both imported and exported commodities. Favorable exchange rates were provided where it was desired either to import or to export a certain commodity. Under this system the foreign exchange rate in regard to the

peseta differed with each commodity, so an exporter of oranges would have one exchange rate and the exporter of onions would sell his products at a different foreign exchange rate.

The import exchange rates are designed to direct the expenditure of foreign exchange to the purchase of commodities which are most important to the Spanish economy. Thus a Spanish importer has to pay only 15.760 pesetas for each dollar to import coal and 34.673 pesetas for each dollar to import an automobile. Also note that Spanish importers must pay 39,401 pesetas for each dollar for machinery for non-industrial use and only 28.369 pesetas for each dollar for machinery for the production of electric power.

The export exchange rates are designed to encourage the earning of the maximum dollar exchange. A high exchange rate is placed on commodities which can be exported without using critical materials, such as books, 26.280 pesetas for each dollar, and ceramics, 26.280 pesetas for each dollar. The rate takes into consideration the competitive situation of each commodity as well as the effect its export might have on the Spanish economy. The export of iron ore is not encouraged and has a very low exchange rate of 13.140 pesetas to the dollar.

These exchange rates are given to illustrate the complicated Spanish foreign exchange system. It is apparent that under such a system the "cost of production" of a commodity has little influence on its competitiveness in international trade.

The following are some official Spanish exchange rates as released by the office of the commercial attache of the Spanish Embassy in Washington, October 21, 1949.

| Commodity | Exchange rate (Pesetas to the $) | Commodity | Exchange rate (Pesetas to the $) |
|---|---|---|---|
| Imports into Spain: | | | |
| Automobiles | 34.673 | Tin | 23.641 |
| Coal | 15.760 | Seed potatoes | 18.912 |
| Drugs | 25.217 | Bauxite | 18.912 |
| Electrical apparatus | 39.401 | Cameras | 39.401 |
| Machine tools | 28.369 | Copper alloys and scrap | 18.912 |
| Palm oil | 18.912 | Machinery for non-industrial use | 39.401 |
| Sugar beet seed | 18.912 | Machinery for production of electric power | 28.369 |

(Continued)

| Commodity | Exchange rate (Pesetas to the $) | Commodity | Exchange rate (Pesetas to the $) |
|---|---|---|---|
| Exports from Spain: | | | |
| Almonds | 19.710 | Iron ore | 13.140 |
| Apricots | 24.090 | Iron pyrites | 17.520 |
| Books | 26.280 | Leather manfactures | 26.280 |
| Bricks | 24.090 | Lemons | 21.900 |
| Capers | 17.520 | Tangerines | 17.520 |
| Ceramics | 26.280 | Bitter oranges | 17.520 |
| Cherries | 24.090 | Sweet oranges | |
| | | Until January 15 | 17.520 |
| Citrus fruit peels and pulp | 19.710 | From January 15 to end of season | 16.425 |
| Citrus fruit extracts | 21.900 | Paprika | 24.090 |
| Cream of tarter | 26.280 | Pottery | 26.280 |
| Essential oils | 21.900 | Raisins | 26.280 |
| Figs (dried) | 21.900 | Tartaric acid | 26.280 |
| Filberts | 21.900 | Tuna liver vitamin oil | 17.520 |
| Fruit juices | 26.280 | Wolfram | 24.090 |
| | | Zinc | 17.520 |

Spain is continuing to carry on its foreign trade with the use of the multiple exchange rate system, which is modified from time to time, and is also using both combined and compensation accounts. As here referred to the compensation account means the type of account in which a raw material is imported and a product manufactured from this material is exported as compensation. The combined account is the type of transaction in which a part of the foreign exchange earned by an export is made available to the exporter. It is the intention of the combined account system that this foreign exchange made available to the exporter will be utilized to purchase necessary commodities for the use in his own business. In practice it did not always work in the intended manner, and orange exporters, for example,

have sold their foreign exchange at very high rates. Under this system a Spanish orange exporter may be more interested in profit from the sale of the earned foreign exchange than in the sale of the fruit itself. While the predevaluation sterling-peseta exchange rate was 44 pesetas to the pound, the black market rate was as high as 240 pesetas to the pound. Under this circumstance Spanish goods were often exported at a loss so as to obtain sterling to sell in the black market. The result has been the import into Spain of British goods at a very high peseta cost. The abuses under the combined account system have been to the disadvantage of reputable Spanish firms who do not countenance such dubious transactions.

United Kingdom

Besides the internal mechanism discussed above for conducting international trade, Spain has found it necessary to negotiate trade agreements with most of her European customers for citrus fruits. While the Spanish sale of citrus fruit to England is primarily through the British Ministry of Food, it has been conducted under a general trade agreement. Under this agreement the items which Great Britain is to export to Spain are specified as are the items which Spain will export to the United Kingdom: sweet oranges, bitter oranges, lemons, essential oils, tangerines, and a long list of raw materials, primarily agricultural products. The list of items which the United Kingdom will sell to Spain includes primarily coal, fertilizers, dyes, electrical equipment, automobiles, and trucks, and a long list of manufactured items.

Belgium

Belgium is another important citrus customer of Spain, and the trade with that country is carried out under an agreement. This agreement is of the usual type now in common use between European countries. It establishes in each country a control agency to keep an account of the trading under the agreement. Through this clearing account, payments are made as the accounts come into balance. The agreement provides for a list of items to be exchanged. The Spanish exports to go to Belgium include oranges and lemons as well as wine, fish products, and a number of raw ores and metals. The list of Belgium exports to Spain includes copper and various types of metal and metal products, including iron plates, tin plate, and a list of manufactured items including railroad equipment, electrical equipment, wood and metal working machinery and many other items of a mechanical nature.

Trading under this agreement, the exporter consigns citrus fruit to the Belgian importer under a minimum guarantee of 160 Belgian francs per American box of 30 kilos net, f.o.b. a Spanish port. The sales prices which serve for control are those realized at the auction sales room at Antwerp, Belgium. Supposedly these sales are checked by an official representative of the Spanish Ministry of Commerce on the spot, and the account of the sales by the Antwerp brokers must be countersigned by such representative.

Any amount over and above 160 Belgian francs f.o.b. is transferred by the importer to the exporter through the clearing account and credited by the Spanish Foreign Exchange Institute at the rate of 35.040 pesetas per 100 Belgian francs (subject to modification in the course of the season). The Spanish Foreign Exchange Institute has undertaken to place at the disposal of the exporter such

overprices at the normal rate of exchange plus a small premium, and the exporter can either import directly certain specified goods or commodities from Belgium, or sell the foreign exchange to other importers of Belgian goods at a premium. The currencies thus obtained from the sales of citrus enable the citrus exporter to recoup his own losses, because the guaranteed minimum price of 160 Belgian francs does not cover the actual costs of fruit and packing, according to Spanish citrus exporters.

This is a very speculative system which often operates to the disadvantage of both the Spanish exporter and the Belgium importer.

The Netherlands

Foreign trade between Spain and the Netherlands is also carried out under a trade agreement, and a recent list includes the Spanish exports to the Netherlands of 30,000 metric tons of oranges, 800 metric tons of lemons, tartaric acid, bitter oranges and products of the juice and rind of citrus fruits, and mercury. The list of the Netherlands exports to Spain includes seed potatoes, potatoes for food, rubber, newsprint, and a small list of manufactured and chemical products.

Western Germany

In 1949 Spain negotiated a trade treaty with the Government of Western Germany with the permission of the occupying military powers. This agreement provided for the mutual exchange of goods between Spain and Western Germany. The amount of these goods to be exchanged was expressed in dollars. This does not mean that dollars were actually expended for these purchases but rather that this was used as a mutually acceptable currency for the measurement of values. Spanish exports to Western Germany included $50,000 worth of essential oils, $75,000 worth of tartaric acid, $3,000,000 worth of oranges, tangerines, and lemons, and a long list of other products such as dry fruits, pulp, mercury, and iron ore. The German export to Spain under this agreement included dyes, pharmaceuticals, textiles, machinery, motors, mining machinery, electrical equipment, precision and optical instruments, and a few agricultural food products including seed potatoes.

This agreement provided that a clearing account be established as an import-export offset account at the bank at Madrid, Spain. This account would be kept in United States dollars. The agreement provided that any balances in excess of 1 million United States dollars shall be liquidated immediately upon the request of the credited in cash United States. This, therefore, is the type of agreement which operates with only one clearing account.

France

France has always been an important customer of Spain, particularly for citrus fruits. When, as after the War, trade is discontinued between the two countries, it is a serious blow to the Spanish citrus industry. Therefore, the trade agreement of 1948, whereby trade between the two countries was reestablished, was welcomed news to the Spanish citrus grower. Under this agreement, in order to establish mutually satisfactory rates of exchange, the rate to be used will be the parity between the two currencies and the United States dollar. The agreement was designed to stimulate and favor certain Spanish exports to France. Included in

this favored list were oranges and lemons, as well as olive oil and a few other products. The export of these items will be subsidized to a degree by the Spanish Government, and the funds for this subsidy will be obtained by surcharges on certain imports from France. In this respect this agreement is similar to that which is in effect between Spain and Switzerland. Under the agreement, Spain agrees to export a long list of items to France, including 100,000 tons of oranges, 8,000 tons of lemons, essential oils valued at 6,000,000 pesetas, and an extensive list of raw materials. French exports to Spain under the agreement include 400,000 tons of phosphate and 210,000 tons of coal and a long list of chemical and manufactured products.

Denmark

The Spanish trade agreement with Denmark has been extended through June 1950. This agreement provides for the export from Denmark to Spain of dried codfish, seed potatoes, horses, penicillin, and various ceramic products. Diesel and electric machinery are also included. The list of items which Spain will export to Denmark includes oranges and tangerines, lemons, fruit juice, fruit pulp, fruit oil and essences, and other agricultural products including cork. This agreement provides for the normal clearing accounts in both countries. However, as a special concession so that exporters and importers in each country may be paid more quickly, a provision has been made whereby an overdraft in the amount of 7,500,000 Danish kroners is permitted. Due to the granting of permission for this overdraft, it is not necessary for the two accounts to come into balance before exporters can be paid.

Sweden

Trade between Sweden and Spain is also carried on under an agreement which contains a complementary list of items to be exchanged in trade. The accounts under this agreement are kept in Swedish kroners in the clearing account maintained in the Swedish bank at Stockholm. The agreement provides that balances in excess of 5 million Swedish kroners are to be settled between the two countries by the sale one to another of gold or mutually agreeable foreign exchange against the Swedish kroner. Under this agreement from July 1, 1948, to June 30, 1949, Spain exported to Sweden 15,000 metric tons of oranges and 1,500 metric tons of lemons and other items. On the list of commodities to be exchanged, the Swedish imports from Spain include, besides citrus fruit, tartaric acid, and other agricultural products, textiles of a wide variety. Other items such as cork, Tungsten ore, and mercury, sea salt, iron oxide, and various chemicals and raw materials were also exported. The items which Sweden exports to Spain include rayon pulp, chemicals, wood pulp, newsprint, paper, lumber, cardboard, and fiber board.

Switzerland

"One of the most complicated of these agreements is the one with Spain signed July 7, 1945 and amended March 22, 1947, to provide for liquidation of part of the 53 million peseta deficit which Spain had accumulated in transactions under the treaty. An excellent description of the workings of the amended agreement is given by Mr. Robert E. Whedbee in a Madrid Embassy report. In trading under the amendment, The Swiss exporter receives from the 'Office de Compensation' in Swiss francs, 100 percent of the value of his exports, the Spanish importer pays in

pesetas to the Spanish Foreign Exchange Institute 143 percent of the listed value of the merchandise, and separate accounts are maintained in both exchange control offices of the listed value of the merchandise and the surcharge. On the other hand, the Spanish exporter receives in pesetas the listed value of his merchandise, while the Swiss importer pays an average of the listed value in Swiss francs less 30 percent. (Swiss exports: 100 SF plus 43 percent equals 361 pesetas; and, Swiss imports: 361 pesetas equals 143 SF less 30 percent.) The average was in practice to be arrived at by special premiums to Swiss importers of certain Spanish products, funds being derived from the surcharge of advances by the Swiss exchange office.

"An additional protocol, dated December 17, 1947, to the 1945 agreement has two unique features. As a further stimulus to Spanish exports, the Swiss 'Office de Compensation' will not in the future authorize the transfer of credits originating from Swiss exports to Spain until either the Swiss creditor or the Spanish debtor has made possible the importation of merchandise from Spain of equivalent value. This 'complementary' procedure in essence designates a second list of Spanish products, the exporter of which receives the stated value in pesetas from the Foreign Exchange Institute, while the Swiss importer must arrange for an export from Switzerland which will be sold in the Spanish market at a premium of up to 150 percent, this premium being equivalent to a maximum deduction of 60 percent from the proceeds of the Spanish export converted to Swiss francs at the official exchange rate. (Swiss export: 100 SF plus 150 percent equals roughly 631 pesetas; and, Swiss import: 631 pesetas equals 250 SF less 60 percent.) The complementary procedure amounts to a system of controlled bartering wherein the Swiss importer or imported produce is subsidized 30 to 60 percent and the Swiss exporter or exported product correspondingly taxed.

"The second feature of the protocol of December 17 of particular interest is the establishing of a third list of Spanish products, one-half of the Swiss francs arising from which will be placed in an account separate from the general clearing account and at the free disposition of the Spanish Foreign Exchange Institute. These products are not subsidized by the Swiss."

Spanish Orange Exports

The accompanying tabulation of orange exports from 1939-40 to 1948-49 indicates how Spain is rebuilding her export markets. It will be noted that after the start of the war in 1940-41, as would be expected, Germany was the primary customer of Spain. During the height of the war these shipments were stopped entirely, but it will be noted that during the years 1947-48 and 1948-49 Germany was again being supplied with fruit.

It will be noted that there has been a change in the pattern of exports to certain European countries, and many have become better customers for Spanish oranges than they were in 1939-40.

It will also be noted that Spain is shipping a few oranges to Argentina. This is no doubt an attempt to help balance the trade from Argentina which has been supplying Spain with large quantities of wheat. Spain has been unable to make payment for this grain or to supply other needed merchandise to Argentina. France and Great Britain are Spain's best customers for sweet oranges with Belgium being third.

Spanish Lemon Exports

In the accompanying tabulation it will be noted that from 1934 to 1948 lemon exports declined considerably. This was caused primarily by reduced production due to the elimination of acreage when other crops proved more profitable than lemons.

France and Switzerland are Spain's best customers for lemons; however, it should be noted that Sweden purchased 82,440 boxes in 1948, and Denmark purchased 61,758 boxes in the same year. These sales to Scandinavian countries are interesting since they probably take a large lemon, which is the size in plentiful supply in Spain and which is acceptable in the Scandinavian market.

How Export Sales Are Made

The export sales of oranges and lemons from Spain are all under agreements and regulations made by the Spanish government. The basic pattern of the flow of trade is determined by the success which is had in negotiating trade agreements or negotiating with the British Ministry of Food. After the pattern of trade has been established, the regulations under these agreements are set forth by the Spanish regulatory bodies prescribing the exchange rates in terms of pesetas with the foreign currencies and also establishing in pesetas the export price. After these agreements and regulations have been prescribed, the foreign importer deals with the Spanish exporter on this basic pattern.

In the accompanying tabulation of official export prices for Spanish sweet oranges for 1948-49, as furnished by the American Consul at Valencia, it will be noted that export prices are given for each variety of orange. It is interesting to note the various ranges in prices, with the price for the seedless Cadenera being higher than the seeded Comuna and the highest price being charged late in the season for the non-blood Berna. It will also be noted, in the case of Great Britain, that after the basic price is established there is a premium for good weight and good condition. This was a requirement in a contract which the Spanish government made with the British Ministry of Food in that year. These prices have been converted at the rate of 16.45 pesetas to the dollar, and again these prices should be considered in light of the Spanish exchange rate. If the free rate were used the prices would be approximately from one-third to one-half those quoted, in terms of dollars.

Official Export Prices for Spanish Sweet Oranges for 1948-1949 Season

The official export prices fixed by the Spanish Government for the export of sweet oranges for the 1948-1949 season were as follows:

| Type of oranges | Destination | Type of shipment | Price in Spanish pesetas | Price in U. S. dollars |
|---|---|---|---|---|
| Navels | Belgium | Box 30 kilos net | 65.00 net | $3.95 |
| | Denmark | Box 30 kilos net | 68.42 less 5% | 4.16 less 5% |
| | Sweden | Box 30 kilos net | 68.42 less 5% | 4.16 less 5% |

(Continued)

| Type of oranges | Destination | Type of shipment | Price in Spanish Pesetas | Price in U. S. dollars |
|---|---|---|---|---|
| Cadeneras | | | | |
| Seedless | Belgium | Box 30 kilos | 64.00 net | $3.89 |
| | Denmark | Box 30 kilos | 65.00 less 5% | 3.95 less 5% |
| | France | In bulk Frontier | 2.00 per kilo net | .06 per lb. |
| | Norway | Box 30 kilos | 66.75 less 7½% | 4.06 less 7½% |
| | Sweden | Box 30 kilos | 65.00 less 5% | 3.95 less 5% |
| | Switzerland | In bulk Frontier | 1.80 per kilo net | .05 per lb. |
| Comuna | | | | |
| Whites (Seeded) | Belgium | Box 30 kilos | 56.00 net | 3.40 |
| | Denmark | Box 30 kilos | 65.00 less 5% | 3.95 less 5% |
| | France | In bulk Frontier | 2.00 per kilo net | .06 per lb. |
| | Great Brit. | Box 30 kilos | 51.60 plus 4.40 premium for good weight & condition. | 3.14 plus .27 premium |
| | Netherlands | Box 30 kilos | 60.00 less 5% | 3.65 less 5% |
| | Norway | Box 30 kilos | 66.75 less 7½% | 4.06 less 7½% |
| | Sweden | Box 30 kilos | 65.00 less 5% | 3.95 less 5% |
| | Switzerland | In bulk Frontier | 1.80 per kilo net | .05 per lb. |
| Sanguinas | | | | |
| Blood ovals | Belgium | On consignment | Min. 45.00 and 50.00 per box 30 kilos, plus premium of 11.00 paid by the I.E.M.E.(Spanish Foreign Currency Institute). | 2.74 and 3.04 plus .67 premium |
| | Denmark | Box 30 kilos | 65.00 less 5% | 3.95 less 5% |
| | France | In bulk Frontier | 2.00 per kilo less 3% | .06 less 3% per lb. |
| | Great Brit. | Box 30 kilos | 51.60 plus premium of 4.40 for good condition and weight. | 3.14 plus .27 premium |
| | Norway | Box 30 kilos | 75.67 less 7½% | 4.60 less 7½% |
| | Sweden | Box 30 kilos | 65.00 less 5% | 3.95 less 5% |

(Continued)

| Type of oranges | Destination | Type of shipment | Price in Spanish Pesetas | Price in U. S. dollars |
|---|---|---|---|---|
| Bernas Valoncia, Lates (Non bloods) | Belgium | On consignment | 45.00 and 50.00 per box 30 kilos plus premium of 11.00 payable by the I.E.M.E. (Spanish Foreign Currency Institute) | $2.74 and 3.04 plus .67 premium |
| | Denmark | Box 30 kilos | 70.00 net | 4.26 |
| | France | In bulk Frontier | 2.00 per kilo less 3% | .06 less 3% per lb. |
| | Sweden Switzerland | Box 30 kilos In bulk Frontier | 70.00 net 2.40 per kilo net | 4.26 .07 per lb. |

## Official Export Prices for Spanish Tangerines for 1948-49 Season

Export prices fixed during the 1948-49 season for tangerines were as follows:

| | Destination | Type of shipment | Price in Spanish pesetas | Price in U. S. dollars |
|---|---|---|---|---|
| Tangerines | Great Britain | | Minimum £ 40.0.0 per 1/ metric ton. | $112.00 |
| | Belgium | | Boxes of 25 kilos net 68.45 net | 4.16 |
| | France | | Boxes of 25 kilos net 60.00 net | 3.65 |
| | Switzerland | | Bulk-Frontier: per 100 kilos: 24.00 net 2/ | 55.95 per metric ton. |

Source: As reported by the American Consul in Valencia, Spain.
1/ English pounds, at $2.80 /£.
2/ Swiss francs. $.23314 per franc.

At the beginning of each citrus season there is always anxiety on the part of the citrus grower as to the success of the Government negotiations in arranging for the sale of fruit in time to meet the requirements of the maturing crop. Usually the season's first big sale is that made to Great Britain, and it usually comprises white oranges, the seeded comuna, and the seedless Cadenera. These white varieties are suitable for the British market, which buys few of the blood varieties. The blood oranges, which ripen later in the season, are disposed of primarily in other Western European markets.

In the season of 1949-50 the British Ministry of Food purchased approximately 75,000 metric tons of sweet oranges, which is approximately 2,250,000 boxes, at a price of 1 pound 6 pence per box, or, at an exchange rate of $2.80 to the dollar, approximately $2.87 per 35 kilo box. This price was built up from a basic price of 17 shillings 6 pence per box, approximately $2.45 for a standard box weighing 30 kilograms net. To this basic price one shilling, or 14 cents, is added for boxes arriving in Great Britain under 2 percent waste. An additional 1 shilling is paid on arrivals which are under 10 percent waste. An additional one shilling per box is paid if the net weight of the fruit is more than 61 pounds upon arrival in Great Britain.

The 1949-50 season is the last in which the sales will be made directly to the British Ministry of Food. In the spring of 1950 an announcement was made that the British Ministry had decontrolled the purchase of Spanish oranges, and, therefore, in the season of 1950-51 British importers will deal directly with Spanish exporters, probably under some trade agreement or at least under currency controls.

Some exchange rates established for 1949-50 for the sale of citrus fruits in Western Europe

Sweden - 1 Swedish kroner equals Spanish pesetas 3.386 until January 15, 1950. Price: f.o.b. per box 30 kilos net weight- navel, common or seedless oranges Swedish Kroner 21.40 less 5 percent agent's commission.

Denmark - 1 Danish Kroner equals Spanish pesetas 2.536 until January 15, 1950. Price: f.o.b. per box 30 kilos net weight - navel, common or seedless oranges Danish Kroner 28.58 less 5 percent agent's commission. One Danish Kroner equals pesetas 3.17 for lemon exports.

France - For Sweet Oranges. One Spanish peseta equals French francs 19.98 until January 15, 1950, and francs 21.52 after January 15, 1950. For Tangerines - 1 Spanish peseta equals French francs 19.98 until January 15, 1950.

Spain with her excellent fruit, reasonable cost of production, and freight rates, and its close proximity to Western European markets will continue to be a major supplier of oranges to Europe and an extremely active competitor with other

winter fruit suppliers. Due to economic conditions in Spain which make other agricultural crops more profitable and less hazardous, it is unlikely that citrus exports in the next 5 years will increase much beyond present levels. It is unlikely that Spanish sweet orange and tangerine exports will exceed 12,000,000 boxes in any year up to 1955.

## SOME ECONOMIC FACTORS

The general economic situation in Spain has greatly influenced the citrus industry in recent years. Spain had just completed its disastrous Civil War prior to the start of World War II. Because of the scarcity of materials and the disruption of European economy during the ensuing 4 years, Spain did not have an opportunity to rebuild her industries as might have been the case under other conditions.

The following statements regarding certain economic factors will help to outline the current economic situation as it applies to citrus:

### Land Tenure

About 90 to 95 percent of Spanish citrus holdings are grower-owned, and only about 5 to 10 percent are operated by renters. When groves are rented the customary citrus rental prices at present range from 50 to 80 pesetas per hanegada per year, or approximately 15 to 25 dollars per acre per year. When a citrus grove is operated by a renter, that arrangement usually maintains itself, because the operator has planted the trees himself, and the land owner cannot recover the property because legislation favors the right of the tenants who have created the citrus grove.

Customarily the citrus grove owner and worker live in a small town, not on the farm. It is only the larger groves which have homes on the property.

### Size of Groves in Castellon Area

The size of citrus properties in the vicinity of Castellon is quite characteristic of the Spanish citrus industry, which is composed primarily of many small holdings. An estimate by a large fruit buyer regarding citrus holdings in the vicinity of Castellon is as follows:

| Number of Groves | Hanegadas | Acres |
|---|---|---|
| 5,000---------- | 1 to 5 | .20 to 1 |
| 5,000---------- | 5 to 10 | 1 to 2 |
| 2,000---------- | 10 to 25 | 2 to 5 |
| 1,000---------- | 25 to 50 | 5 to 10 |

(Continued)

| Number of Groves | Hanegadas | Acres |
|---|---|---|
| 500---------- | 50 to 100 | 10 to 20 |
| 200---------- | 100 to 300 | 20 to 60 |
| 100---------- | Over 300 | Over 60 |
| 2 or 3---------- | Over 500 | Over 100 |

This distribution is further confirmed by records, inspected by the author, which indicated that it was necessary to purchase the fruit of 89 property owners in order to obtain 800 tons of blood oval oranges. This indicates that less than 9 tons of fruit on the average was obtained from each grower. On similar records it was observed that it was necessary to purchase the fruit of 47 growers to obtain 222 tons of white oranges. Therefore, less than 5 tons of this variety of fruit was obtained from each grower. The small size of properties is further indicated by the fact that this fruit buyer attempted to obtain fruit from some of the larger plantings, and therefore the above figures are not entirely representative.

It is estimated that one man can care for approximately 10 hanegadas (approximately 2 acres), doing all cultivation, pruning, irrigation, and other work. Since the majority of the holdings are smaller than 10 hanegadas, many of the grove owners have other part-time occupations. They usually work for other growers or in other crops at seasons of peak labor demand in March, April, and May, when wages are high due to the labor demand of citrus, rice, and grain planting. Wages at such times may be as much as 40 pesetas ($2.44) a day, which is nearly twice that of the daily wage at seasons of low labor demand in August, September and October.

## Taxes

Taxes on citrus properties are levied by the local Government in accordance with the evaluation of the property. For a tax base, such evaluation is approximately 40 to 50 percent of current market price. In 1949, taxes on a citrus grove were approximately 40 pesetas per hanegada. This tax represents an increase of approximately 40 percent during the last 5 years. In addition to this tax on real property, there is a personal income tax, and the following scale gives the scheduled rate of taxation. However, it should be kept in mind that due to the lack of records and other factors, the actual tax imposed may be approximately 50 percent of those scheduled. It is a common practice for the Government to come to individual agreements with the taxpayers.

| Net Incomes | Rate of Taxation |
|---|---|
| 60,000 to 100,000 | 7½ percent |
| 100,000 to 150,000 | 18 " |
| 150,000 to 250,000 | 20 " |
| 250,000 to 500,000 | 27 " |
| 500,000 to 1,000,000 | 33 " |
| Over 1,000,000 | 44 " |

Current Value of Real Estate

In 1949 the sales price of producing citrus orchards varied between 5,000 to 10,000 pesetas per hanegada ($1,538 to $3,075 per acre). The higher price was paid for groves which had best trees, best soil conditions, and cheapest irrigation water. Lower prices were paid for properties where expensive pumping operations were involved to obtain irrigation water. Under present conditions of shortage of forage and foodstuffs irrigated bare land is selling for 4,000 to 9,000 pesetas ($1,229 to $2,767) per hanegada and reasonably level dry farmed land is selling for approximately 2,500 to 3,000 pesetas(769 to 921 per acre) per hanegada. The dry-farmed land is at an exceptionally high price at this time, due to the shortage of bread grains and the high prices being paid for such products.

The Wages of Labor

The wages of labor vary according to the nature of employment, as to whether it is seasonal or permanent. Seasonal labor rates vary according to labor demand, wages being as high in 1949 as 40 pesetas ($2.43) a day in March, April, and May and falling to approximately half that figure in August, September, and October. Year-round citrus labor living on the farm received approximately 18 pesetas ($1.09) per day. This includes a paid vacation of 1 week and another 2 weeks off at various times during the year, at the time of fetes, etc. Such laborers usually receive other benefits on the farm, such as permission to keep a certain amount of livestock and to receive some of the produce raised on the farm, such as potatoes and beans. When the grove is pruned, the orange prunings are saved. The dried leaves are fed to sheep and goats owned by the workers, and the wood is used for firewood. The weeding of small vegetables is done mostly by women who receive approximately 10 pesetas ($0.61) a day for 7 hours of work. In packing houses women receive from 10 to 12 pesetas ($0.61 to $0.73) a day depending on whether or not their work requires standing.

Wages are increasing gradually, and as this occurs there is more interest in acquiring labor-saving machinery, both on the farm and in packing plants. The minimum wages of labor are set by Government regulation.

The accompanying translation of the official bulletin from the province of Castellon regarding farm labor regulations for that province gives in detail the official wage rates in force on March 26, 1949. These wages in pesetas have been converted at the rate of 16.45 pesetas to the dollar; which is the exchange rate for sweet oranges. If the free and unofficial rate of exchange for the peseta to the dollar, such as the rate in existence at Tangiers, were used, the wages given in dollars would be from one-half to one-third the dollar amounts given. Under systems of regulated currencies the dollar conversion rates, and therefore the cost of production expressed in converted dollars, have little meaning.

CHAPTER VII - SECTION FOUR, MARCH 26, 1949.

Minimum Wages 1/

Art. 50. - Minimum daily wage for the permanent worker.--The minimum daily wage for the permanent worker, according to the zone where he works, shall be

1/ Source--Spain. Castellon. Boletin Oficial de la Provincia de Castellon CXVII (37): 5,7,3. Farm Labor Regulations for the Province of Castellon de La Plana.

as follows:

| | Pesetas | Dollars 2/ |
|---|---|---|
| First zone | 15.00 | 0.91 |
| Second " | 13.20 | .80 |

As for the farm overseers and the men who drive a yoke of oxen or a team, they will come under the provisions of Art. 53.

Art. 51. - Minimum daily wage for the temporary or casual worker on unspecified tasks.---

| | Pesetas | Dollars |
|---|---|---|
| First zone | 18.75 | 1.14 |
| Second " | 16.80 | 1.02 |

In these wages shall be included the sums for Sunday holiday, vacation, non-recoverable fiestas, and Christmas and July 18 bonuses.

Art. 52. - Minimum daily wages for special jobs, including Sundays, non-recoverable fiestas, vacations, and Christmas and July 18 bonuses.--The wages which are to govern in each of the zones for the tasks listed below are as follows:

First.--Common work on herbaceous crops.--(Arable land or field), jobs of a laborer.

a) Laborer's work. (Daily wages)

| | First Zone | | Second Zone | |
|---|---|---|---|---|
| | Pesetas | Dollars | Pesetas | Dollars |
| Deep digging with two plows | 31.00 | 1.88 | 25.00 | 1.52 |
| Ordinary digging | 29.00 | 1.76 | 25.00 | 1.52 |
| Breaking the clods and preparing the land for planting, making ridges | 25.00 | 1.52 | 22.00 | 1.34 |
| Transplanting (pulling plants) | 25.00 | 1.52 | 22.00 | 1.34 |
| Planting | 25.00 | 1.52 | 22.00 | 1.34 |
| Day irrigation | 19.50 | 1.19 | 17.50 | 1.06 |
| Night irrigation (50% more) | 29.25 | 1.78 | 26.25 | 1.60 |
| Distributing fertilizer | 25.00 | 1.52 | 22.00 | 1.34 |
| Spraying | 28.00 | 1.70 | 25.00 | 1.52 |
| Harvesting alfalfa | 28.00 | 1.70 | 25.00 | 1.52 |
| Harvesting cereals and vegetables | 28.00 | 1.70 | 25.00 | 1.52 |
| Digging tubers and bulbs (potatoes, sweetpotatoes, peanuts, etc.) | 31.00 | 1.88 | 25.00 | 1.52 |

(Continued)

2/ Converted at 16.45 pesetas to the dollar.

| | First Zone | | Second Zone | |
|---|---|---|---|---|
| | Pesetas | Dollars | Pesetas | Dollars |
| Gathering vegetables and green legumes | 25.00 | 1.52 | 22.00 | 1.34 |
| Working on the vegetable patch | 28.00 | 1.70 | 25.00 | 1.52 |
| Digging holes | 25.00 | 1.52 | 22.00 | 1.34 |
| d) Orange cultivation (daily wages) | | | | |
| First working of groves | 28.00 | 1.70 | 25.00 | 1.52 |
| Second " " " | 25.00 | 1.52 | 22.00 | 1.34. |
| Weeding | 19.50 | 1.19 | 17.50 | 1.06. |
| Plowing | 19.50 | 1.19 | 17.50 | 1.06 |
| Propping | 19.50 | 1.19 | 17.50 | 1.06 |
| Picking oranges (men) | 20.00 | 1.22 | 17.00 | 1.03 |
| " " (women and children over 14) | 15.00 | .91 | 12.00 | .73 |
| Foreman | 21.50 | 1.31 | 18.50 | 1.12 |
| Fertilizing | 23.00 | 1.40. | 20.00 | 1.22 |

Art. 56. - Woman's wages.--When not expressly determined in these ordinances, the payment of woman for equal labor shall be 70% of the wages fixed for the male.

On farms having houses for permanent workers, the operator may agree with such workers that the members of their households, for a recompense, may perform secondary farm tasks, such as feeding the workers, the poultry, etc.

CHAPTER VI - Art. 32

. . .

When there are workers of opposite sexes, the dormitories shall be absolutely independent of each other, utmost pains being taken to provide the women with the required conditions of comfort and hygiene.

In considering the wages of labor, the nature of the Spanish economy should be kept in mind. As has been noted, the property has been divided into many small individually-owned farms. In addition to commercial crops, these farms also produce a large percentage of the food for the farmer and his family. Another source of non-wage income, carried on extensively in many parts of Spain, is the practice of share-cropping small plots of land.

The average Spanish agricultural worker does not live by the wages of his labor alone, but supplements this income by commodities raised on a small plot of land owned by himself or members of his family.

On large Spanish orange groves where as many as 50 people might be employed for tillage, on-the-farm housing is usually provided by the owner. In such cases, in addition to houses and wages, the employees usually have plots of land where

they raise food crops individually or on a cooperative basis. These crops, such as beans, nuts, and potatoes, are customarily shared with the employees, and often employees get a weekly ration of such food items from the owner.

In rural Spain one has the impression that this is not basically a money economy, but rather the larger portion of the real earnings of the people is obtained from home-grown produce. It is this factor which stabilizes what would otherwise be an impossible situation, considering the wage rates and prices of food.

Income from Grove Operation

Under existing prices it may be estimated that, on the average, a grove in the Castellon area produces a gross income of approximately 1,000 to 1,200 pesetas per hanegada ($308 to $369 per acre) per year. If it is estimated that the average cost of production is approximately 700 pesetas per hanegada ($215 per acre) the net profit on a crop is from 300 to 500 pesetas per hanegada ($92 to $154 per acre) per year in citrus. One of the reasons citrus plantings are not being increased is the high price of other crops. Land used to raise alfalfa will at present return a higher profit than that in citrus, and it is now possible to make a net of 1,000 pesetas per hanegada ($308 per acre) from the sale of alfalfa. As domestic animal population increases, it may be anticipated that such forage crops and other land uses will continue to be so profitable for several years that there will be little impetus to extend present citrus plantings.

The prices paid to growers for fruit in 1949 in Castellon were as follows: for blood ovals at the beginning of the season, from 62 centavos to 96 centavos per kilo ($1.19 to $1.85 per box), the average price being 80 centavos a kilo ($1.54 per box). Due to the demand for blood ovals created by the sale to the French at the close of the season, fruit growers were paying as high as 2 pesetas per kilo ($3.86 per box) for the fruit on the tree. The average price paid to growers for blood ovals was 1.75 pesetas per kilo ($3.38 per box) on the tree. Packers found approximately 10 percent of blood ovals to be culls.

In white oranges the season in January 1949 started at 65 centavos per kilo for fruit on the tree. At the season's close the price was 79 centavos per kilo ($1.52 per box) the average being approximately 78 centavos ($1.51 per box). Approximately 20 percent of this fruit was found to be culls.

According to fruit buyers, these prices for citrus may be considered as satisfactory to growers.

It may be estimated that the domestic price of fruit for interior consumption is approximately 70 percent of the export price.

It is estimated that one man can farm approximately 10 hanegadas of orchard, doing all the operations himself. If his grove returns 1,200 pesetas per hanegada ($369 per acre), and the cost of production is approximately 700 pesetas per hanegada ($215 per acre), such a grower would receive approximately 5,500 pesetas per year ($1691 per acre) over and above his costs. The economic position of such an owner-operator may be compared with that of the farm laborer who receives 18 pesetas a day ($1.09), and, therefore, an annual income of approximately

6,500 pesetas ($1999 ) per year. The owner-operator receives greater income because a large share of the cost of production may be considered as wages of labor and 5,500 pesetas ($1691 ) as profit. He is also assured of remunerative use of his labor throughout the entire year, which is not always true in the case of the employed farm hand.

## COST OF PRODUCTION

The cost of production in Spanish citrus groves in an exceedingly interesting and complex subject. The complexity of the subject is due to the difficulties of arriving at an accurate exchange rate which will truly represent the cost in terms of dollars and also due to the fact that the properties are small. Another complicating factor is that it is difficult to measure the real cost, since the operator cultivates the orchard himself in many cases and a part of his income is wages of labor.

The author has been fortunate in having seen certain bookkeeping records and to have obtained data which will be informative in the discussion of this subject. Some of the factors which make up the cost of production will be discussed as a basis for arriving at a reasonable range of cost which represents conditions today.

### Yield of Spanish citrus groves

As was discussed in the section on cultural practices, the Spanish citrus groves are cultivated by hand, and the quality of the work is generally excellent. Because of the hand cultivation methods, a maximum utilization of land is made, a great number of trees are planted per acre, and there is no damage to trees such as is common with mechanical tillage. As groves were visited in March 1949, it was evident that well-kept groves had a very high range of production per tree. When this is multiplied by the large number of trees per acre, the production per acre is generally larger than that of most citrus areas in the United States.

To illustrate this point, records were obtained of the 46 representative Spanish groves. In tabulation, the groves marked a, b, c, and d are all from the Ribera, one of the best citrus districts in Spain. These production records are all for the Comuna variety of non-blood seeded orange, which is very vigorous and highly productive. These records cover production for the years 1945, 1946, 1947, and 1948, and it will be noted that the production has been increasing as fertilizers and pesticides become increasingly available. The groves in this area, however, are now at approximately their peak of production. Their foliage is dark green in color and sufficiently heavy so one cannot see through the trees. It is unlikely that additional applications of fertilizer will increase production to any marked degree. The general high level of production is remarkable, averaging about 300 boxes per acre. Spanish citrus growers state that their orchards produce nearly twice as much as the California citrus orchards on the average, and the yield records which the author has been able to obtain tend to substantiate their statements.

In the tabulation of yield records from 42 groves, other varieties of oranges are included, primarily the Comuna and Sanguinas varieties of blood oranges. There is also one yield record for navel oranges. Like the records of yield for the four groves in the Ribera, these groves also show increasing production in the last 3 years due to better cultural conditions. These groves are representative of several districts. The groves of Sangunto are from the La Plana which is a district of lower production than the Ribera. The yield of groves from Gandia also show an average production lower than that of the Ribera. The district of Gandia is representative of the seacoast district near the Marina and south of Valencia. Therefore, in these two tabulations of grove yields we have the sweet orange districts in Spain covered by both varieties and by distribution between different citrus producing districts. The tabulation indicates that there is wide range in the yield from Spanish citrus groves. However, the general range of yield is high, and it will be noted that there are few that had a yield of less than 150 boxes to the acre in 1948-49, and that many groves are as high as 300 and 400 boxes to the acre. These yield records are an excellent basis for the adjustment in the commercial citrus acreage in Spain.

Costs of Operation

There is considerable variation in the cost of operation of a Spanish citrus orchard. It is difficult to compare the cost of operation of the low, flat La Plana region of Castellon, with its small trees and high frost hazard, with the high,hilly light-soiled region of the Ribera, with its large trees and higher irrigation costs. Below is quoted the actual operation cost of a grove which may be considered as typical of low cost operation at this time:

Operation Costs

One hanegada (1/5 of an acre) 832 square meters

| | Pesetas | Dollars |
|---|---|---|
| 3 men for first year's ground breaking at 26 pesetas | 78.00 | 4.74 |
| 6 men for cultivation with special hoe at 23 pesetas | 138.00 | 8.39 |
| 3 men for pruning, etc. at 30 pesetas | 90.00 | 5.47 |
| Irrigation (application of water) 8 times per year at cost of 16 pesetas (2 pesetas per hour) | 128.00 | 7.78 |
| Cost of water based on elevation from 60 meters 10 pesetas per 1000 liters per hour and one hanegada needs one hour irrigation X 8 | 80.00 | 4.86 |
| Cost of water (per gravity) only cost of application | --- | --- |
| Calculate 50 percent gravity and 50 percent elevation irrigation | | |
| Fumigation pesetas 2.50 per tree and 35/40 trees per hanegada (Fumigation only necessary every other year) | 100.00 | 6.07 |
| Fertilizer 30 kilos sulphate ammonia at 2 pesetas per kilo | 60.00 | 3.65 |
| 100 kilos superphosphate of lime at 0/40 kilo | 40.00 | 2.44 |
| | 714.00 | 43.40 |
| Taxes | 40.00 | 2.44 |
| | 754.00 | 45.84 |

After the inspection of cost records from several groves in the various citrus producing areas, it is found that the range of cost of operation will vary between 900 pesetas a hanegada for a grove either well located, making possible economies in operation, or poorly cared for, to 1,200 pesetas for a well-cared-for hanegada or one located in a high cost region by reason of pest control difficulties or the use of pumped water from deep wells. In the latter case, many citrus properties in Spain obtain water from depths up to 200 feet, which may cost 150 pesetas per hanegada per year for irrigation.

The above example of cost will be that of a commercially operated grove which is maintained as a business by hired labor. It should be kept in mind that this is not typical of grove operation in Spain. The average citrus property is a small grove either owned or leased by the operator, the usual size being from 3 to 7 hanegadas. A hanegada is approximately 1/5 of an acre, or the usual size of a large city lot. If the grove is exceptionally small, the owner-operator may have

other employment outside of the care of the grove; however, if the grove is approximately 10 to 20 hanegadas, depending on location, it will occupy his entire time to care for the property.

Spain is still largely a medieval society in that its people utilize land for the sustenance of the family unit. Commercial production for sale is something over and above the food which is produced for home use. It is not basically a money economy. While the small owner-operator of a grove produces oranges for sale, he also will produce a large part of his family's food, either on the borders of the property line or by planting a portion of the space between trees to other annual crops. Keeping this in mind, one should note that the critical costs of production are those which involve materials or services which have to be purchased. The following tabulation would give approximate ranges of these costs:

| | Cost per Hanegada | |
|---|---|---|
| | Pesetas | Dollars |
| Water for irrigation | 0-150 | 0-9.12 |
| Pest Control | 50-150 | 3.04-9.12 |
| Fertilization | 50-150 | 3.04-9.12 |
| Taxes | 40-50 | 2.43-3.04 |
| Other Expenses | 50-100 | 3.04-6.07 |
| Total | 190-600 | 11.55-36.47 |

In evaluating factors which will influence cost of operation in the future, the cost of the above items will greatly influence citrus production. Since the orchard properties may largely sustain the family unit, the average of these two limits, or 365 pesetas, may be considered a basic critical cost which must be earned by the grove if the property is to stay in production.

Cost of Operation and Size of Grove

Growers state that in some areas such as La Plana region, one man can care for 10 hanegadas of grove, and in the Ribera where the trees are larger, a man may successfully care for 20 hanegadas. Considering that most groves are owner-operated, this has a bearing on costs. If we consider that the average wage of the farm worker is 25 pesetas a day, with 300 working days in the year, this would make an annual income of approximately 7500 pesetas. Considering this as a basic rate, the cost of operating a 10 hanegada (2 acre) grove might be as follows:

| | Pesetas | Dollars |
|---|---|---|
| Wages of Operator | 7500 | 455.93 |
| Irrigation Water | 800 | 48.63 |
| Pest Control | 1000 | 60.79 |
| Fertilization | 1000 | 60.79 |
| Taxes | 400 | 24.32 |
| Other Expenses | 1000 | 60.79 |
| Total | 11,700 | 711.25 |

Considering the same type of operation with a 20 hanegada (4-acre) grove, costs might be as follows:

| | Pesetas | Dollars |
|---|---|---|
| Wages of Operator | 7500 | 455.93. |
| Irrigation Water | 1600 | 97.27. |
| Pest Control | 2000 | 121,58. |
| Fertilizer | 2000 | 121.58 |
| Taxes | 800 | 48.63. |
| Other Expenses | 2000 | 121.58 |
| Total | 15,900 | 966.57. |

By this it will be noted that in the first example the cost per hanegada is approximately 11,701 pesetas, and, in the 20 hanegada grove, approximately 795 pesetas per hanegada.

Costs of operation in Spain are still abnormal, due to the necessity of obtaining some fertilizing and pest control materials from unofficial sources and due to the fact that growers are still rebuilding orchards from damage suffered in the Civil War and in the 1946 freeze.

A Computation of the Cost of Operation of One Hanegada 1/ in 1946 2/

| Tasks: | Pesetas | Dollars |
|---|---|---|
| Digging, 2½ days at 30 pesetas | 75.00 | 4.56 |
| Weeding, 4 days at 25 pesetas | 100.00 | 6.08 |
| Other jobs, 2 days at 25 pesetas | 50.00 | 3.04 |
| | 225.00 | 13.68 |
| **Irrigation:** | | |
| Four irrigations, including wages of irrigation man | 25.00 | 1.52 |
| **Fertilizers:** | | |
| There have been delivered to the farmers during the present year, 13 kg. of nitrate of soda and 6 of ammonium sulfate, equivalent in all to 15 kg. of ammonium sulfate at the official price of 2 pesetas per kg. The rest, up to 35 kg., the farmer is supposed to buy at the price of 7 pesetas per kg. | | |
| 45 Kg. superphosphate of lime, at 0.50 pesetas | 22.50 | 1.37 |
| 15 Kg. ammonium sulfate, at 2 pesetas | 30.00 | 1.82 |
| 20 Kg. ammonium sulfate, at 7 pesetas | 140.00 | 8.51 |
| 15 Kg. potassium chloride, at 0.55 pesetas | 8.25 | .50 |
| 5 Kg. sulfate of iron, at 0.35 pesetas | 1.75 | .11 |
| | 202.50 | 12.31 |

1/ One hanegada is approximately one fifth of an acre.
2/ Source: La Riqueza Citricola Espanola by Luis Roson Perez, page 59.

| | Pesetas | Dollars |
|---|---|---|
| **Fumigation:** | | |
| Half of cost, fumigation | 90.00 | 5.47 |
| Half of cost, spraying | 60.00 | 3.65 |
| | 150.00 | 9.12 |
| **Official charges:** | | |
| Tax and social taxes | 50.00 | 3.04 |
| Tax on estab. wealth | 7.50 | .45 |
| Field pesos | 0.10 | .01 |
| Watchman, Agr. Chamber | 5.00 | .30 |
| | 62.60 | 3.80 |
| **Land rent:** | | |
| Rent | 75.00 | 4.56 |
| **Risks:** | | |
| 15 percent of working capital | 111.31 | 6.77 |
| **Interest:** | | |
| 5 percent for 6 months on above expenses | 21.33 | 1.30 |
| **Amortization:** | | |
| Percentage of rentals value of the land | 30.00 | 1.82 |
| **Management and Administration:** | | |
| 2 percent of total costs | 18.08 | 1.10 |
| Total | 920.82 | 559 8 |

AVERAGE COSTS OF OPERATING ONE HANEGADA OF CITRUS IN 1948.

| Factors | Irrigated with Gravity Water | | Irrigated with Pumped Water | |
|---|---|---|---|---|
| | Pesetas per Hanegada | Dollars Per Acre | Pesetas per Hanegada | Dollars Per Acre |
| Various tasks, labor | 225.00 | 69.19 | 225.00 | 69.19 |
| Irrigation | 25.00 | 7.69 | 154.00 | 47.36 |
| Fertilizers | 202.50 | 62.27 | 202.50 | 62.27 |
| Fumigation | 150.00 | 46.13 | 150.00 | 46.13 |
| Taxes (official charges) | 62.60 | 19.25 | 62.60 | 19.25 |
| Rent | 75.00 | 23.06 | 75.00 | 23.06 |
| Risks | 111.31 | 34.23 | 130.36 | 40.09 |
| Interest | 21.33 | 6.56 | 24.98 | 7.68 |
| Amortization | 30.00 | 9.23 | 30.00 | 9.23 |
| Management | 18.08 | 5.56 | 21.08 | 6.48 |
| Total Cost | 920.82 | 283.17 | 1,075.52 | 330.74 |

Source: La Riqueza Citricola Espanola by Luis Roson Perez, page 61.

In the accompanying tabulations of cost for low cost and high cost groves as computed by Mr. Roson in his excellent book on the Spanish citrus industry, our selection of data regarding the cost was computed in 1947-48. If these are considered as cash cost today they certainly are quite representative of the cost situation. This range of cost is used in calculating our break-even cash cost of operation. In the course of the author's visits to Spanish citrus properties, he has had opportunities to inspect cost records from several operations. On the best-operated groves the cost usually ranged between the figures given, and the highest cost of operation seen was one involving a large property kept in excellent fashion where the cost in 1948-49 averaged 1,200 pesetas ($364.70 per acre).

Cost of Production

In summarizing the yield and cost-of-operation factors, an examination of records of yield of 46 groves will disclose that a low yield of 125 arrobas per hanegada and a high yield of 200 arrobas per hanegada are conservative figures. There are few yields lower than 125 arrobas per hanegada, and there are a considerable number which are higher than 200 arrobas per hanegada.

As was stated above for the operational cost, we shall choose the range given by Mr. Roson with the high of 1,075.2 pesetas and a low of 920.82. These figures are higher than some we have seen; however, we believe that this will be a conservative range and will include the cost of the majority of Spanish citrus growers producing commercial fruit for export in 1949.

The above yield and cost factors may be summarized as follows:

| | High | Low |
|---|---|---|
| Cost of operation | | |
| Pesetas per hanegada | 1,075.52 | 920.82 |
| Dollars per acre 1/ | 326.91 | 279.88 |
| Average yield | | |
| Arrobas per hanegada | 200 | 125 |
| Boxes per acre | 394 | 246 |
| Cost of production | | |
| Pesetas per arrobas | 5.37 | 7.36 |
| Pesetas per 30 kilo box | 12.88 | 17.66 |
| Dollars per box 1/ | .78 | 1.07 |

Break-even costs f.o.b. Spanish ports

The break-even costs in 1949 may be calculated as follows:

| | High | Low |
|---|---|---|
| Cost of production | | |
| Pesetas per arroba | 7.36 | 5.37 |
| Pesetas per 30 kilo box | 17.66 | 12.89 |
| Dollars per box 1/ | 1.08 | .79 |

| | High | Low |
|---|---|---|
| Cost of picking and packing | | |
| Pesetas per 30 kilo box | 26.85 | 20.45 |
| Dollars per box 1/ | 1.63 | 1.24 |
| Transport to port | | |
| Pesetas per 30 kilo box | .85 | .20 |
| Cents per box 1/ | .05 | .01 |
| Total | | |
| Pesetas per box | 45.36 | 33.54 |
| Dollars per box 1/ | 2.76 | 2.04 |

1/ Converted at 16.45 pesetas to $1.00.

Exchange rates and the cost of production: In comparing the costs of Spanish orange production by using a dollar conversion, the result will depend on the conversion rate used.

The conversion rate used in this report is 16.45 pesetas to the dollar, the rate in 1949-50 for sweet oranges. This is the most realistic official rate for citrus.

A comparison of the costs resulting from the several exchange rates follows: A comparison of break-even costs by different conversion rates of the peseta.

Break-even costs per 30-kilo (66-pound net) box f.o.b. Spanish ports:

| | High | Low |
|---|---|---|
| Pesetas per 30 kilo box | 45.34 | 33.52 |
| Dollars per box | | |
| Basic rate of 10.95 pesetas to the dollar | 4.13 | 3.05 |
| Sweet orange rate of 16.45 pesetas to the dollar | 2.75 | 2.04 |
| Tourist rate of 25.00 pesetas to the dollar | 1.81 | 1.34 |
| Free Tangier rate approximately 40 pesetas to the dollar | 1.13 | .84 |

## Cost Involved in Bulk Shipments

In the above cost computation we have given the break-even cost for packed fruit. In considering the cost factors in the Spanish citrus industry, it must be kept in mind that a large percentage of the citrus fruits are not sold in packed form but are sold in bulk either to the domestic market or to France. The costs involved in preparation of fruit for bulk shipment are much less than those involved in preparing a packed box.

In the section on marketing we have made a computation that the cost of picking and preparing a bulk shipment of fruit for market is approximately 9.65 pesetas per 30 kilos (66 pounds) of fruit, or, at the rate of 16.5 pesetas to the dollar, approximately 58 cents per 30 kilos of fruit. These costs are approximately 1/3 the amount necessary to prepare a packed box.

Considering these factors and the cost of production which we have calcualted the break-even costs of bulk fruit shipment are as follows:

The break-even costs in 1949 for fruit shipped in bulk may be calculated as follows:

| | High | Low |
|---|---|---|
| Cost of Production | | |
| Pesetas per arroba | 7.36 | 5.37 |
| Pesetas per 30 kilo box | 17.66 | 12.89 |
| Dollars per box | 1.08 | .79 |
| Cost of Picking and Wrapping | | |
| Pesetas per 30 kilos of fruit | 9.65 | 9.65 |
| Dollars per 30 kilos of fruit | .58 | .58 |
| Transport to Port | | |
| Pesetas per 30 kilos of fruit | .85 | .20 |
| Cents per 30 kilos of fruit | .05 | .01 |
| Total | | |
| Pesetas per 30 kilos of fruit | 28.16 | 22.74 |
| Dollars per 30 kilos of fruit | 1.71 | 1.38 |

In computing the dollar cost of the bulk shipment of fruit we have used the exchange rate of 16.45 pesetas to the dollar which, as has been said before, is the official exchange rate for sweet oranges. If the free Spanish exchange rate were used the dollar cost of this fruit would be from one-half to one-third less than the dollar figures shown.

In considering the cost of the bulk shipment of fruit, there are hidden savings which are not apparent in the figures. Fruit shipped in bulk may be of mixed varieties; the comuna, the cadenera, and blood oranges may be mixed in the same lot. It is also possible to mix several grades and to ship such grades as may be available. In this way much of the cost of grading and sorting is avoided. The bulk shipment of fruit is a very economical way to bring citrus supplies to the French market. This is no doubt of advantage both to the Spanish citrus growers and also to the French consumer.

Table 23.--Spain: Yield of four representative Spanish orange groves, comuna variety in arrobas and boxes by district.

| Season | Grove A Calsiners district | | Grove B Benegida district | | Grove C Barranquet district | | Grove D Puig Gros district | |
|---|---|---|---|---|---|---|---|---|
| | Arrobas per hanegada 1/ | Boxes per acre | Arrobas per hanegada | Boxes per acre | Arrobas per hanegada | Boxes per acre | Arrobas per hanegada | Boxes per acre |
| 1945 | 172 | 343 | 188 | 375 | 260 | 518 | 300 | 597 |
| 1946 | 160 | 319 | 204 | 406 | 247 | 492 | 329 | 654 |
| 1947 | 167 | 333 | 196 | 391 | 285 | 568 | 236 | 469 |
| 1948 | 176 | 350 | 219 | 437 | 300 | 597 | 429 | 854 |

1/ One arroba weighs 12½ kilos or 27.56 pounds. One hanegada is one-fifth of an acre.

Table 24.--Spain: Yield of 42 representative Spanish orange groves 1946-48

| District & grove | | Variety | 1946-47 | | 1947-48 | | 1948-49 | |
|---|---|---|---|---|---|---|---|---|
| | | | Arrobas per hanegada | Boxes per acre | Arrobas per hanegada | Boxes per acre | Arrobas per hanegada | Boxes per acre |
| Almazora | 1 | Comuna | --- | --- | 35 | 70 | 84 | 167 |
| Faura | 1 | Comuna | --- | --- | 89 | 177 | 127 | 253 |
| | 2 | Sanguina | --- | --- | 276 | 550 | 150 | 299 |
| Sagunto | 1 | Navel | 209 | 416 | 153 | 305 | 280 | 558 |
| | 2 | Comuna | --- | --- | 115 | 229 | 136 | 271 |
| | 3 | Sanguina | 167 | 333 | 172 | 343 | 230 | 458 |
| Alcacer | 1 | Comuna | --- | --- | 601 | 1,197 | 460 | 916 |
| | 2 | Comuna | --- | --- | 404 | 805 | 479 | 954 |
| | 3 | Sanguina | --- | --- | 128 | 255 | 89 | 177 |
| | 4 | Sanguina | --- | --- | 81 | 161 | 78 | 155 |
| Alcira | 1 | Comuna | --- | --- | 162 | 323 | 183 | 364 |
| | 2 | Comuna | --- | --- | 250 | 498 | 185 | 368 |
| | 3 | Sanguina | --- | --- | 288 | 574 | 311 | 619 |
| | 4 | Sanguina | --- | --- | 55 | 110 | 66 | 131 |
| Alberique | 1 | Comuna | --- | --- | 175 | 349 | 223 | 444 |
| | 2 | Comuna | --- | --- | 35 | 70 | 73 | 145 |
| | 3 | Sanguina | --- | --- | 45 | 90 | 75 | 149 |
| | 4 | Sanguina | --- | --- | 193 | 384 | 189 | 376 |
| Carcagente | 1 | Comuna | 686 | 1,366 | 468 | 932 | 624 | 1,243 |
| | 2 | Comuna | 265 | 528 | 209 | 416 | 228 | 454 |
| | 3 | Sanguina | --- | --- | 79 | 157 | 136 | 271 |
| | 4 | Sanguina | 64 | 128 | 159 | 317 | 103 | 205 |
| Puebla Larga | 1 | Comuna | --- | --- | 192 | 382 | 146 | 291 |
| | 2 | Comuna | --- | --- | 165 | 329 | 152 | 303 |
| | 3 | Sanguina | --- | --- | 142 | 283 | 121 | 241 |
| | 4 | Sanguina | --- | --- | 298 | 594 | 262 | 522 |
| Algemesi | 1 | Comuna | --- | --- | 187 | 372 | 113 | 225 |
| | 2 | Comuna | --- | --- | 233 | 464 | 249 | 496 |
| | 3 | Sanguina | --- | --- | 213 | 424 | 321 | 639 |
| | 4 | Sanguina | 80 | 159 | 188 | 374 | --- | --- |
| | 5 | Sanguina | --- | --- | 269 | 536 | 311 | 619 |
| Gandia | 1 | Comuna | --- | --- | 67 | 133 | 85 | 169 |
| | 2 | Comuna | --- | --- | 200 | 398 | 148 | 295 |
| | 3 | Sanguina | --- | --- | 168 | 335 | 150 | 299 |
| | 4 | Sanguina | --- | --- | 265 | 528 | 244 | 486 |
| | 5 | Sanguina | --- | --- | 284 | 566 | 338 | 673 |
| Bellreguart | 1 | Sanguina | --- | --- | 163 | 325 | 174 | 347 |
| | 2 | Sanguina | --- | --- | 140 | 279 | 119 | 237 |
| Oliva | 1 | Sanguina | --- | --- | 146 | 291 | 166 | 331 |
| | 2 | Sanguina | --- | --- | 111 | 221 | 101 | 201 |
| | 3 | Sanguina | --- | --- | 164 | 327 | 154 | 307 |
| | 4 | Sanguina | --- | --- | 142 | 283 | 1106 | 211 |

Converted in arrobas of 12 1/3 kilos.
1 hanegada = 1/5 acre.

## PROCESSING

One of three major processing plants for citrus is located approximately 3 kilometers north of Burriana on the road which connects Burriana with Castellon. As with most processing plants, it has been expanded very greatly from the original installation and now fills three buildings, having a floor space of approximately 40,000 square feet. In general, the property is of excellent construction, being of stone and concrete with a roof supported by steel trusses. Power for the plant is steam furnished by an English boiler burning orange wood. This plant is known as Valencia, S.A. It produces single-strength juices which are sold in casks with $S.O.^2$ as an added preservative, in liter bottles without preservative, and during normal years in Number 2 tins. Rind peel, as well as peel pulp, is also sold to Scandinavia in casks preserved with $S.O.^2$. This plant differentiates between peel pulp and what it calls citrus pulp, a product manufactured from the flesh of the fruit itself without the peel. Essential oils are also produced, as is a seed oil.

### Manufacturing Process

The manufacturing process varies according to the products being produced. All fruit is received from groves in wooden field boxes containing approximately 25 kilos of fruit. The fruit is stored in these boxes until it is needed in the operations. When essential oils are being produced, the fruit goes through a washer and a brush drier, from which the fruit is carried on conveyors to the rind oil extracting machines. The fruit falls from the conveyor into small crib bins in front of each installation. A woman operator takes the fruit from this bin and places it in a revolving spindle similar to a lathe. On a projecting arm a sharp-pointed metal "pencil" presses against the peel of the orange as the fruit revolves, causing the skin oil to be released. The oil drops through a funnel-like arrangement into a glass container beneath the machine. As the operation on each fruit is completed, a foot-operated clutch releases the mechanism, and the fruit is placed by hand on another conveyor where it is carried to a juice extracting process. In the part of the plant doing oil extracting, there are places for approximately 60 operators. The oil-extracting machinery is manufactured in Italy and is similar to that used in the extraction of oil from lemons.

The fruit carried from the oil extractors goes by conveyor to another part of the building, where it is sliced in two by a revolving disk. The halves of fruit are carried in front of rows of juice extractors, stainless steel machines which are manufactured in France. The halves of fruit are placed by hand upon turning spindles. There are three sizes of spindles to accommodate various sizes of fruit, and the fruit goes through a sizer before it is carried into the juicing compartment. The juice flows down a stainless steel carrier to a pulp separator, from there to an aerator, from there to a flash pasteurizer which both pasteurizes and cools the juice, thence to a de-aerator and vacuum tank, where it is further processed before the canning or bottling operation. At present, glass liter bottles are used exclusively for distribution of the product in Spain due to the shortage of tinplate. When essential oils are first extracted from the peel before the juicing process, the peels cannot be used for the manufacture of the rind peel, which is sent to

Scandinavia. It is planned to add a dehydrator for the manufacture of cattle food in order to utilize this by-product.

When the plant is manufacturing rind peel, the essential oil extractors are not used, and the fruit is fed directly from the washer to the juicing machinery.

It is interesting to note that the bottled single-strength juice keeps satisfactorily in liter bottles in which it is placed hot, the bottle being capped with an ordinary metal cap which is lined with foil. In the cooling process, a vacuum is created in the bottle, aiding in the preservation of the juice. The product as tasted was of fairly good quality and certainly much better than most squash drinks tasted in other parts of Europe.

The plant operates a laboratory and gives every evidence of being in first class operation. The capacity of the plant is 6 million liters or 1-1/2 million gallons of single-strength juice per season. This is a large operation, and the fact that this is a profitable organization was indicated by five new trucks of a United States make which were in view on the premises. The plant also operates its own machine shop for plant maintenance, and, as exchange is available, it is the indicated intention of the management to expand the plant and to install automatic juice-extracting machinery.

A major citrus processing plant, is located at Carretera de Daimuz No. 1, Gandia, Province of Valencia. This operation is dissimilar to that observed in the vicinity of Burriana, since it is equipped to process other vegetables and fruit products besides citrus. Since the visit was made in June, preparations were under way to begin the processing of tomato paste and other similar products. Apparatus was also on hand for the juice extraction and processing of grapes. The plant is housed in a rather old building, and the juice extraction machinery is old and is constructed primarily of wooden parts, which would seem to be very difficult to keep clean. The equipment of the plant, as observed, consisted of a laboratory, office, juice and oil extraction room, small concentrating vats for citrus, vegetable pulp, and grape juice, and equipment for another concentrating process described as concentration with "cold." This equipment was unlike anything the author has observed before in any processing plant. The primary compressors were manufactured in Germany. This process was described in the Florida Canner, issue of February 28, 1948 as follows: "First, the juice is frozen, Second, the frozen juice is ground into small particles, and third, these frozen particles are subjected to pressure which separates the juice from the water, leaving the water in the form of ice."

Since no sterilization is involved in the process, the product prepared must be kept either under refrigeration or preserved by the addition of $S.O.^2$, which is reported to be the process at this plant. However, the Florida Canner stated that the sugar content of the juice obtained by this method makes it self-preserving. This method of concentration produces a 5-to-1 concentrate of excellent flavor. However, the process would seem slow and complicated for commercial operation. A laboratory representative stated that the plant had a capacity of 500,000 liters of juice per week. However, there was no evidence that extraction equipment of this capacity was available, and estimates should be considered very optimistic. We were told that present juice extraction equipment was soon to be replaced by equipment purchased in Florida.

Company officials estimated that, working at capacity, the plant may produce approximately 3,000 gallons of orange juice concentrate per day.

The products now being manufactured by the plant are:

1. Single-strength juice to which the preservative $S.O.^2$ is added. A product which is shipped to Great Britain in casks for use in the "squash" industry.

2. Concentrated citrus juice, primarily orange. However, samples of grapefruit and lemon were also observed.

3. Citrus peel in quarters, which is shipped in casks either salt brined or with $S.O.^2$ preservative. This product is used in the manufacture of marmalades and is also utilized in confections as a salt cured product and in candies as a glazed fruit product.

4. Citrus pulp, which consists of some juice of the fruit together with the fruit pulp which does not include the peel. This product is also used in the manufacture of marmalades and to some extent in the preparation of some citrus drinks similar to squash.

5. Essential citrus oils for use both by perfume manufacturers and by the manufacturers of essences for use in soft drinks, pastries, confections, etc.

6. Some dry peel is also manufactured. However, this is done by natural dehydration by the sun, the peels being placed on a large platform and being turned occasionally by hand. Such dried pulp would be used for cattle food.

The processes of manufacture may be described as follows:

a. Essential oils. Two kinds of oil extraction apparatus are utilized. The first is similar to that used at the Burriana plant, in which the fruit is placed in a lathe-like apparatus, the oil being released from the skin by a metal-like pencil. This type of extraction makes a high-grade product which is utilized by perfume manufacturers.

A second extraction process consists of revolving perforated wheels, against which the rind of the fruit is pressed, similar to a grater. The rind pulp thus created is placed in a press for the extraction of the oil. This latter product is distilled to two qualities and is used exclusively in the manufacture of confections, soft drinks, pastries, and such products. About 30 of these oil extraction machines were seen.

After the extraction of the rind oil, the fruit is taken to a machine where it is sliced into two halves; the halves pass down the extraction machine and are placed upon revolving spindles by hand. The extraction machine observed by the author was apparently of old construction. It was not stainless steel, being composed mainly of a wooden framework, and the funnel-like collecting device which surrounds each spindle was also of wooden construction. After the juice is extracted, it is de-aerated, and the pulp is removed and placed in

casks for shipment under S.O.$^2$. Or, after the pulp is removed, it is de-aerated and placed in a vacuum tank for the making of concentrate. A cold room is available for the storage of all citrus concentrate so produced.

A sample of diluted orange concentrate tasted in the laboratory was of apparent excellent quality insofar as taste was concerned. The main concentrating still was of small capacity. However, in another room of the plant is installed a great deal of machinery, such as compressors in which we were told that concentration by cold was accomplished. When peels and quarters are being manufactured, essential oils are not extracted, and the oranges are fed first into the juice extraction machinery. The inside pulp is removed by hand scraping, and the end of each quartered peel is cut off after the each half orange has been cut in two.

From casual observation, the author would estimate the capacity of the plant for citrus not to exceed 10½ metric tons of fresh fruit per day.

The amount of product manufactured depends upon the price of fruit, which is not processed when prices are high. It was explained that it is the policy of the firm first to make sales and then to produce on order.

It was indicated that single-strength juice in casks preserved with S.O.$^2$ is sold at 5 shillings ($0.70) per (imperial) gallon f.o.b. London, a similar price to that paid for a like product in North Africa.

The price of the essential oils varies in accordance with the quality, the approximate price of the best quality for perfume being 100 pesetas per liter ($2.76 per pound). The second quality made from refining the shredded pulp is priced at approximately 60 pesetas a liter ($1.66 per pound), and the third quality, also manufactured from the shredded pulp, at 30 pesetas a liter ($0.83 per pound).

A new citrus processing plant has been constructed at Carcagente. This plant is of very modern construction and is housed in a new building. The processing equipment was obtained from Orlando, Florida, and a concentrator is installed.

The fruit is received at the plant and is dumped into a vat, where the fruit is carried by circulated water to a conveyor which carries it into a storage bin to be held for processing. These bins will hold approximately 600 tons of fruit.

This plant is highly mechanized as compared with other Spanish processing plants, since it was designed on American standards. As in other food processing plants in Spain, FESA manufactures its own cans at the plant. The machinery for doing this is of Italian manufacture and is automatic, there being conveyors from one machine process to the other. Some of the Number 10 tins are received flattened and are reshaped and completed at the plant, and the Number 2 tins are manufactured from tinplate. According to published figures, the plant has a seasonal capacity of 16,000 kilos (35,274 pounds) of 65 brix concentrate, 175,000 kilos (385,805 pounds) of single strength juice, 30 tons of peel cattle food, and 300 liters (661 pounds) of essential oils. Automatic canning machinery can fill approximately 100 No. 2 cans per minute.

During seasonal operation the plant operates on a 24-hour basis and can consume 250 tons of fresh fruit in a 24-hour period. Single-strength juice, as well as being packed in No. 2 tins, is also sold in casks preserved with $S.O.^2$ for utilization in the British squash industry.

This organization also operates a number of fresh fruit packing plants, from which culls will be sent to this processing plant. However, the culls from these operations will not furnish sufficient tonnage for its operation, and it will be necessary to purchase additional fruit. In Spain the blanco or comuna is the variety most suitable for processing.

The plant has an auxiliary electric generator powered by a 600 H.P. English diesel engine. This is necessary to run the plant when electric power is not available from regular sources. Interruptions in current are frequent and usual.

While the three major citrus processing plants are located at Gandia, Burriana, and Carcagente, there are many more processors in Spanish citrus districts. The records of the "Sindicato" indicate that there are at least 50 such operations in Spain, 17 of which are within the city of Valencia, 12 in small towns around Valencia, 5 in Castellon, and 4 in towns near Castellon. Approximately 12 plants exist near Murcia, some at Malaga, and a few at Seville.

The processing of fruit at these small plants is on an exceedingly simple basis. Hand juice extractors are used, and the primary production is single-strength juice, which is sold in casks with the added preservative sulphur dioxide. These plants tend to operate sporadically in accordance with the market for processed juice and the availability of fruit at prices which they can afford to pay. Since very little capital equipment is involved, it is economically possible to operate in this manner. There is a great deal of flexibility in this industry and it is a common practice for one plant to purchase the juice of other extractors. This would usually occur when a sale is made over and above the capacity of the individual processor.

These small juice plants purchase dropped fruit after high winds, or fruit which may drop because of lack of export market. At times when fruit is made unsalable through fresh channels due to frost damage, they are able to salvage considerable portions of the crop. While the price of fresh fruit for processing varies in accordance with conditions, foreign industry representatives state that prices are usually from one-half to two-thirds of prices paid for fruit for export.

One plant in the vicinity of Valencia concentrates juices sold in Spain and shipped in bulk to Scandinavia, where it is packaged in glass containers for consumers. A small flask of essential oil is sold with each bottle of concentrate, this being added as the product is diluted for consumption. Members of this firm indicate that they have been manufacturing products similar to this since 1913.

It is interesting to note that this concentrated orange juice product was for sale at Murcia, a citrus area where few oranges are produced and none are available in the summer months. It was also observed for sale at Madeira and Seville, and some advertising was being done by means of posters.

It is likely that the new plants producing concentrate by modern methods will offer very severe competition to these small old plants producing a product of lower quality.

During World War II, when it was difficult to obtain rail transportation for fresh fruit, the production of processed citrus was stimulated. The Syndicate estimates that in 1940, when the largest amount of fruit was juiced, approximately 90 thousand tons (2,834,486 boxes) of fresh fruit was consumed in this manner. In the 1948-49 season it is estimated that 50 thousand metric tons (1,574,714 boxes) of fresh fruit was processed. If present plants operated to full capacity it is estimated that 100,00 tons (3,149, 429 boxes) of fresh fruit would be required. However, due to competitive conditions, it is doubtful if world markets would consume the type of products produced in this quantity.

It is estimated that in a normal year 100,000 tons of processed citrus would be distributed as follows amongst the several varieties: 1/

| Variety | Metric Tons | Boxes |
|---|---|---|
| Oranges | 80,000 | 2,519,544 |
| Lemons | 8,500 | 246,566 |
| Mandarins | 3,500 | 110,230 |
| Petit grain orange and mandarin 2/ | 6,600 | 207,862 |
| Orange-flower water 2/ | 700 | 22,046 |
| Grapefruit | 700 | 19,290 |

This volume of fruit would produce the following quantities of processed products, according to this estimate:

| Juices | Kilograms | 1000 Pounds |
|---|---|---|
| Natural orange | 14,000.000 | 30,864 |
| Natural lemon | 2,500.000 | 5,512 |
| Natural grapefruit | 400.000 | 882 |
| Concentrated orange | 1,000.000 | 2,205 |
| Concentrated lemon | 100.000 | 220 |
| Concentrated grapefruit | 40.000 | 88 |
| Concentrated tangerine | 38.000 | 84 |

See footnotes on next page.

| Essences | Kilograms | 1000 Pounds |
|---|---|---|
| From pressed orange | 100.000 | 220 |
| From distilled orange | 15.000 | 33 |
| From sophisticated orange | 400 | 1 |
| From lemon pressed by needle | 20.000 | 44 |
| From lemon distilled by pressure | 7.000 | 15 |
| From lemon | 200 | 3/ |
| From pressed mandarin | 7.000 | 15 |
| From mandarin, petit grain | 8.000 | 18 |
| From grapefruit | 4.000 | 9 |
| From orange or lemon flower (Neroly) | 500 | 1 |

| Peels | Kilograms | 1000 Pounds |
|---|---|---|
| Fresh orange | 1,000.000 | 2,205 |
| Fresh lemon | 200.000 | 441 |
| Dry orange | 600.000 | 1,323 |
| Pulp for cattle feed | 2,500.000 | 5,512 |
| Citric acid | 10.000 | 22 |
| Orange blossom | 50.000 | 110 |
| Orange -flower water | 230.000 | 507 |

1/ La Riqueza Citricola Espanola by Luis Roson Perez, page 145.
2/ In the case of these two products it is assumed that reference is made to an estimate of the quantity of fruit lost by production of these non-fruit products.
3/ Less than 500 pounds.

## Tests of Spanish Citrus Juices

As visits were made to Spanish processing plants, samples of the juice products were obtained. They were brought to Washington and tested in accordance with the Department of Agriculture standards. The testing was performed by the Standardization and Inspection Division of the Fruit and Vegetable Branch of the Production and Marketing Administration of the Department of Agriculture. The accompanying tabulation of the results of tests on three of these products shows the new and the old in the Spanish processing industry. The canned product was produced by a modern installation; both of the bottled products were produced by a traditional processing plant.

Both the orange and lemon bottled products are packed in an ornamental glass bottle with a glass stopper and cork ring seal. The lower portion of the bottle contains a concentration of juice and salt. In a valve in the stopper is a concentration of essential oils. In preparing the beverage for consumption, the juice is diluted in accordance with the directions on the label, and the essential oils are added to give flavor and bouquet.

Table 25.—Spain: Analyses of citrus juice

| Analysis category | Unit | Orange | | Lemon |
|---|---|---|---|---|
| | | Canned | Bottled | Bottled |
| Date of analysis | | December 7, 1949 | January 5, 1950 | January 5, 1950 |
| Size of container | | No. 2 | | |
| Fluid measure | Fluid ounces | 18.5 | 250 | 250 |
| Vacuum | Inches | 8 | | |
| Density | Degrees brix | 12.8 | 28.7° | 21.0° |
| Anhydrous citric acid per 100 ml | Grams | 0.8 | 4.94 | 4.94 |
| Pulp | Percent | 8 | | |
| Recoverable oil by volume | | Very faint trace | | |
| Ascorbic acid per 100 ml | Milligrams | 47.78 | 104.0 | 50.4 |
| Color | | Excellent | | |
| Absence of defects | | Markedly free | | |
| Flavor | | Very good | Very poor | Fairly palatable |
| Ratio of soluble solids to citric acid | | 16:1 | 5.81:1 | 4.25:1 |
| Sulphur dioxide per 1,000 ml.(P.P.M.) | | | 45.2 | 31 |
| U. S. grade | | A or Fancy (sweet) | None comparable | None comparable |

Tested by Standardization and Inspection Division, Fruit and Vegetable Branch, Production and Marketing Administration of the United States Department of Agriculture.

Essential oils

As in Italy, there is a large essential oil industry in Spain, and citrus products are an important part of the oils produced. A further discussion of some of the processed products will be found in the section on the bitter orange industry at Seville. In the sweet orange district, the essential oils of orange, lemon, tangerine, and grapefruit are produced in both the natural and the distilled forms. Petit grain also is produced by distilling the essences obtained from boiling the leaves primarily of the tangerine. Neroli or orange flower oil is also produced by distilling the vapor by boiling orange blossoms. Orange flower water is produced as a by-product of the manufacture of orange oil.

Both the quality and the price of essential oils are controlled by regulations established by the Spanish Fruit Syndicate. The official export prices, as well as the grade classification for the various essential oils, are given below in order that both the quality and the prices of the Spanish products may be compared.

Experimentation

Spain is interested in modernizing and developing its citrus processing industry. The old methods of processing, using sulphur dioxide as a preservative for juices, is still in use, and this type of product comprises a large percentage of Spanish processed citrus juice production. This type of processing involves a minimum of equipment and little scientific technique. As standards of consuming countries improve and as processed citrus juices become more plentiful, it is thought likely that these older methods will be unable to compete with flash pasteurized juices.

For this reason the experiment station at Burjasot is experimenting with the flash pasteurization and de-aeration of juices. At the experiment station the author has sampled some canned pasteurized citrus juices of excellent quality. Experiments blending grape and apricot juices with citrus juices are also being investigated. Some very excellent canned strawberry juice has been produced.

Manuel Herrero de Egana, the director of the experiment station, and Alejandro Reig Feliu have published an account of the experiments on flash pasteurization and de-aeration. A translation of excerpts from this publication indicates the nature of the experiment, and is also interesting, as it comments on the processing characteristics of the Spanish citrus fruits.

Experiments on De-aeration and Flash Pasteurization of Spanish Citrus Juices 16/

During the 1941-42 season, 38 experiments were made with fruits of the following varieties: "Visieda", "Cadenera" (a non-blood), "Oval doble fina" (blood), and "Berna" (non-blood) oranges; "Comun" lemon; "Duncan" and "Marsh" grapefruit.

The best results were obtained with the"Duncan" grapefruit which, with an acidity of 4.3 percent, and pasteurization temperature of 80 degrees C. (176 F.), kept their basic qualities for more than nine months when stored at room temperature.

The "Berna" and the"Blood" oranges, with acidity of about 0.8 - 1.0 percent during the final maturity period, kept poorly, even those stored at a low (39 to 42 degrees F.) temperature; naturally, they did not ferment, but they developed foreign flavors which in time entirely changed the flavor of the original juice.

16/ Spain. Ministerio de Agricultura. Instituto Nacional de Investigaciones Agronomicas. Centro de las Cuencas del Jucar y del Turia. Estacion Naranjera de Levante. (Ministry of Agriculture. National Institute of Agronomic Research. Jucar and Turia Basin Center. Levant Orange Station. Burjasot (Valencia). Memorandum No. 93, Dec. 1947.
Primeras Experiencia s sobre la Desaireacion y Pasteurizacion Rapida de los Jugos de Agrios (First Experiments on the De-aeration and Flash Pasteurization of Citrus Juices), by Manuel Herrero de Egana and Alejandro Reig Feliu.

The "Cadeneras" (non-blood seedless oranges) gave the best samples. Generally speaking, pasteurization temperatures above 90 degrees C. (194 degrees F.) gave a "cooked" taste.

Tests made with the "Comun" lemon did not prove satisfactory.

All the fruit was picked in a mature stage, and the average sugar content, for the varieties of oranges, varied between 7 and 9 percent.

The experiments were continued in the 1942-43 season, 10 of them. Tests were made on the "Common Mandarin"; the "Comun" and "Oval doble fina" oranges from Alcira; the "Washington Navel", from the Market of Valencia. Various tests were made with the addition of sugar, grape concentrate, and saccharin.

The "Common Mandarin", processed in December with 2.4 percent of acidity and pasteurized at 85 degrees (185 degrees F.), was bottled, part in the natural state, and the rest with the addition of 5 percent of sugar. It kept well in the cellar and in the cold (39-42 degrees F.) storage, especially the sweetened sample.

The "Common" proved to be of excellent quality, both in its natural state and with the addition of the different sweeteners; the 1.3 percent acidity and 9 percent of sugars, reached in the month of April, make a very praiseworthy mixture. The addition of grape concentrate and saccharin changes the flavor, but the change is not readily perceptible.

Trials with the "Washington navel", collected early in March, proved satisfactory; the 11.6 percent sugar content, combined with an acidity of 1.4 percent made the addition of sweeteners practically unnecessary; we could observe that the bitter taste developed in small proportion, and only at the end of a long storage period.

The "Blood" varieties at the end of the season with 1 percent acidity and 9 percent of sugars keep well for the first few months, but later develop foreign flavors; the pasteurization temperature, about 95 degrees (203 degrees F.), changes the color of the pigments which give a special color to the juice.

In the 1943-1944 campaign we continued the studies on the varieties "Washington navel" and "Oval doble fina". Fifteen experiments were made.

We made tests with the first variety in different phases of maturity, from December to May, also obtaining samples with the addition of sugar in proportions of 2 to 5 percent. The results were good, especially with the fruits picked in April. We have not observed the marked development of the bitter taste which nearly all the North American investigators mention. The bottles kept in a cold place (39-42 degrees F.) practically keep their qualities for more than a year.

The studies made with the "Oval doble fina" (a blood orange) gave better results than those obtained with this variety in previous years.

During the 1945-1946 season our studies were broadened to include oranges from Burriana, representative of the Plain of Castellon, and those from Alcira,

by the Valencia shore.

The varieties tested in Castellon were the "Common" (non-blood), "Common Mandarin," "Washington navel," and "Oval doble fina" (blood), and in Alcira, the "Common" and "Cadenera" (non-bloods).

The first samples from Burriana were taken on January 9, 1946. A week later, on the 16th, the most severe frost of the century occurred. We performed 20 experiments which, initiated for the study of the conservation of the natural or sweetened juice, proved by the force of circumstances to be a study of the characteristics of juices from frozen fruits.

From the experiments made before the frost, four in number, we can deduce that the best were those from the "Common Mandarin" which, with an already very low acidity of 0.7 percent, and 9 percent of sugars, conserved the characteristic qualities of mandarin juice, especially when kept in a cold place. The two samples of "Common" had an extraordinarily high acidity, about 2.3 and 2.7 percent; they kept well, but without the addition of sugar were not acceptable. The test made with the "Washington navel" variety is the one, out of all made with this variety, which showed the strongest development of a bitter taste in storage.

The experiments performed after the frost were for the purpose of testing its disastrous effects on the fresh or pasteurized juices. The taste of this kind of juices from frozen fruits is entirely changed and is absolutely no reminder of their origin. We could observe that, in the course of the season, a decline in the acidity occurred, which is normal, combined with the stabilization of the sugar content; the yield of juice likewise dropped, reaching figures around 8 percent in the last tests of the month of March, while the normal yields are from 38 to 40 percent.

The final experiments in this first series of tasks were made in March, 1946, with "Cadeneras" and "Common" oranges from Alcira. The results were highly satisfactory, and although pasteurization at 84-86 degrees (183.2 - 186.8 F.) altered the flavor and aroma of the fresh juice, this alteration was a minimum; the color of the juice was natural, and its characteristics remained constant for a year and a half, kept in the cellar, after the juice had been bottled for two summers. Although the coarse material of the pulp was deposited in the lower part of the bottles, the top was not clarified, thus showing that the enzymes were inactivated. The fruit was of excellent quality and the juice contained about 1 percent acidity and 10 percent of sugars.

In coming years we propose to continue these experiments, utilizing a new and more perfect laboratory installation, which will undoubtedly permit us to set some definite standards for the de-aeration and pasteurization of citrus juices and very clearly establish the keeping qualities of the different varieties in the principal and characteristic producing zones, by determining the possibilities of this process, the first advance in which we have just obtained through seven years of experimentation.

Experiments in blending juices 17/

An experiment is being carried on with the blending of citrus juices with other juices, such as the apricot. A translation has been made of one of these experiments, which will indicate the trend of Spanish investigation in this field.

The average yield of apricot juice obtained by extraction is about 40 percent. The process surely would be made in better conditions and the yield would be higher employing a continue-extractor type tomato-sieve, in which a helicoidal screw presses the pulp, which was before separate of its stones, against the bottom, while the sap goes through a much finer sieve placed in the low half of the cylinder.

Surely the apricot juice recently extracted is not at all of agreeable flavor. The sap is doughy and sugar and acidity are in small quantity and it is necessary to elevate the appropiate aroma and taste of the apricot by means of other elements in small quantities.

After several trials we arrived at the conclusion that adding to the juice an equal volume of a sirup of 200 gr. sugar per liter of water, the nectar takes the fluidity of a drink and at the same time the scarcity of sugar is supplied. The low acidity of the sap was first mitigated mixing citric acid to reach a pH = 4, but nevertheless to have obtained the harmonization of the proportions of acid and sugar, the aroma and the flavor lacked in the nectar.

Adding to this nectar small quantities of orange and lemon juice we proved that at the same time, the necessary citric acid was embodied and the savor became extraordinarily better without it being possible to identify any strange taste. The proportion of 30 c.c. of orange and lemon juice per liter of nectar gave very good results.

The nectar, prepared in this way, was submitted to the treatment we already have explained of desaireation and a rapid pasteurization by 85-86 degrees C. The temperature of filling was fixed by 77-78 degrees C. The posterior tindalisation by 75 degrees served to assure the stability.

In new tests we shall try to eliminate this last operation with the design to give a greater simplicity and continuity to the process.

17/Source: Aprovechamiento industrial del albaricogue en forma de bebida, por Alejandro Reig Feliu, Ingeniero Agronomo, Alcala 54, Madrid, Diciembre 1948.

Some Economic Factors of the Processing Industry

Due to the type of fruit used, the juice type from Spain will be similar to that of the California juice. It is reported that concentrate in Spain has a high ascorbic acid content and averages approximately 350 milligrams of ascorbic acid per hundred milligrams of juice.

It has been the usual practice in Spain to sell culls on the local market or as loose fruit in export. The disposal of this culled fruit to large processing plants such as FESA will require the development of a new pattern in the industry.

It may be computed that in 1948-49 plants were paying approximately 75 centavos per kilo ($0.001 per pound) for fruit used, and it may also be estimated that the yield of juice was approximately 40 percent of the fresh fruit tonnage. Market concentrate was being sold at 25 shillings ($3.50) per Imperial gallon, c.i.f. London, which may be compared to $3.25 per U. S. gallon, paid to American producers, and a reported 30 shillings ($4.20), an Imperial gallon, c.i.f. London, paid to Palestinian producers.

Single-strength juice sold in casks to England is reported to be sold for 4 shillings ($0.56)18/ an Imperial gallon f.o.b. Spain. It may be computed that the freight from Spain to England is approximately 3 pence ($0.04) per gallon. Therefore, the c.i.f. price would be 4/3 ($0.60). This may be compared with 5 shillings ($0.70) an Imperial gallon, c.i.f. London, which is reported being paid for a similar product furnished by North African producers. The freight of single strength juice in casks is 80 shillings ($11.20) per ton from Valencia to London.

Essential oils are priced according to quality, the best quality for perfumers being sold at approximately 100 pesetas per liter ($2.76 per pound), other grades at 60 and 30 per liter ($1.66 to $0.83 per pound). Another price scale of essential oil produced from pressed juice pulp is 60 to 100 pesetas per kilo ($1.66 to $2.76 per pound) f.o.b. Spain.

There is an excellent market in Spain for dried peel pulp. Dried peel has long been used here but the product has usually been an inferior quality produced by sun drying. The current price of mechanically dehydrated pulp of high quality is 1½ pesetas per kilo ($0.04 per pound) plus 25 centavos ($0.02) for the bag.

Export Prices and Characteristics for the Classification of Essences

Below we offer the official export prices for Spanish essences, for the 1943-44 season.

18/ Converted at $2.80 to one pound sterling.

| Essences of special qualities: extra, prime or sponge | Pesetas/Kilogram | Dollars per lbs. 1/ |
|---|---|---|
| Orange | 202,50 | 5.57 |
| Lemon | 292,50 | 8.04 |
| Mandarin | 247,50 | 6.81 |
| Pomelo | 247,50 | 6.81 |
| Distilled orange | 157,50 | 4.33 |
| Distilled lemon | 157,50 | 4.33 |
| Distilled tangerine | 157,50 | 4.33 |

| Essences, first grade | Pesetas/Kilogram | Dollars per lbs. |
|---|---|---|
| Orange (pressed) | 180,00 | 4.95 |
| Lemon | 247,50 | 6.81 |
| Mandarin | 225,00 | 6.19 |
| Pomelo | 225,00 | 6.19 |
| Distilled orange | 130,50 | 3.59 |
| Distilled lemon | 135,00 | 3.71 |
| Distilled tangerine | 135,00 | 3.71 |

1/ Converted at 16.45 pesetas to $1. Source: Esencias de la Corteza del fruto de los Agrios, by Alejandro Reig Feliu, Book No. 66, December 1945, page 250.

Be it understood that these prices are minimum, containers and packing included, for merchandise Franco frontier or Spanish port.

In the invoices or export and commercial documents sent to clients, the qualities of the products must be clearly stated, so that they can be checked by the proper Official Organization; this means that if the lots do not agree with the samples, or the latter agree with the characteristics established as types, exportation will be stopped, and the case will be brought to the attention of the General Bureau of Commerce, for the application of the corresponding penalty to the exporter.

For carrying on this kind of operation, official authorization has been given to the inclusion in the invoice of the commission of the representative, if there is one, at a minimum rate of 5 percent, with a notation of the name of this representative.

In export contracts the statement must be made that the Spanish tribunals shall be competent to settle the differences between seller and buyer, using as a basis the certification of the Center for inspection of merchandise.

Specifications which the Essences must meet for Exportation.

The official instructions provide that the essences extracted, by the various procedures now used, are to be pure and exempt from any kind of adulterants. They must be perfectly filtered, and their physical characteristics are to fluctuate within the following limits:

## SPECIAL ESSENCES

### Orange

Density: between 0.848 and 0.860
Index of refraction: between 1.4755 and 1.4765
Color: light red
Odor: characteristic of fruit, without showing symptoms of becoming rancid.
Aspect: brilliant

### Lemon

Density: between 0.855 and 0.860
Index of refraction: between 1.4730 and 1.4750
Color: light yellow
Odor: characteristic of fruit
Aspect: brilliant

### Mandarin

Density: between 0.840 and 0.855
Index of refraction: between 1.4750 and 1.4760
Color: light orange red

### Pomelo

Density: between 0.850 and 0.860
Index of refraction: between 1.4500 and 1.4650
Color: grayish white

### Distilled orange

Density: between 0.840 and 0.850
Index of refraction: between 1.4730 and 1.4745
Color: transparent white

### Distilled lemon

Density: between 0.845 and 0.850
Index of refraction: between 1.4730 and 1.4740
Color: transparent white

### Distilled mandarin

Density: between 0.840 and 0.850
Index of refraction: between 1.4740 and 1.4750
Color: transparent white

All the essences must present a brilliant aspect and have an odor characteristic of the fruit, and the distilled essences must not have a "cooked" odor.

## FIRST GRADE

### Orange

Density: between 0.850 and 0.860
Index of refraction: between 1.4760 and 1.4790
Color: dark red

### Lemon

Density: between 0.860 and 0.885
Index of refraction: between 1.4740 and 1.4780
Color: yellow, with greenish also accepted

### Mandarin

Density: between 0.858 and 0.870
Index of refraction: between 1.4760 and 1.4770
Color: brilliant orange red

### Pomelo

Density: between 0.860 and 0.865
Index of refraction: between 1.4650 and 1.4700
Color: grayish white

### Distilled orange

Density: between 0.845 and 0.855
Index of refraction: between 1.4720 and 1.4730
Color: transparent white, dark gray being accepted

### Distilled tangerine

Density: from 0.845 to 0.855
Index of refraction: between 1.4730 and 1.4740
Color: white, light gray being accepted

### Distilled lemon

Density: between 0.850 and 0.858
Index of refraction: between 1.4730 and 1.4740
Color: transparent white, light gray being accepted

Production of essences

Approximately the following quantities were manufactured in Spain during the 1942-43 season:

| | Kilograms | Pounds |
|---|---|---|
| Essence of orange, pressed | 94.100 | 207,453 |
| " " " distilled | 13.950 | 30,754 |
| " " " deterpenated | 327 | 721 |
| " " lemon, pressed | 18.000 | 39,683 |
| " " " distilled | 6.100 | 13,448 |
| " " " deterpenated | 128 | 282 |
| " " mandarin, pressed | 6.800 | 14,991 |
| " " pomelo | 3.780 | 8,333 |

## A HISTORICAL COMPARISON

In 1925, Edwin Smith, specialist in foreign marketing of the United States Department of Agriculture, made a study of the Spanish citrus industry, published July 28, 1925. Comparing Mr. Smith's observations with conditions today, it is amazing how few changes have been made in the Spanish citrus industry. In this 25-year interval packing houses have been improved; however, the simple-type packing house, practically without machinery, which Mr. Smith described, is still in use in some places in Spain. The methods of production have changed little, and the pattern of Spanish citrus marketing remains approximately the same. In 1925, citrus fruits exported to England and most western European markets were packed in boxes, usually the Spanish half case weighing approximately 112 pounds. Even in 1925 the majority of the shipments to France were in bulk.

Mr. Smith comments upon the simple packing houses with no machinery, and the practice of growers selling to cash buyers. He also comments upon the excessive and rough handling of the fruit from the orchard to the packing house. Picking bags are still not used, and the oranges are dropped from the hand to the ground and piled in the orchard awaiting transfer to boxes or cases in which they are shipped from the orchard to the packing houses.

In 1925 Mr. Smith calculated the cost of operation of the Spanish citrus grove as follows:

| | Cost per acre |
|---|---|
| Rent ..... | $58.32 |
| Fertilizer ..... | 29.16 |
| Plowing and hoeing ..... | 29.16 |
| Irrigation ..... | 3.65 |
| Total ..... | 120.29 |

Mr. Smith estimated that the average production in 1925 was approximately 150 112-pound cases per acre.

Today's estimate is from a low of $279.88 per acre to $326.91 per acre, converted at the rate of 16.45 pesetas to the dollar. These costs would be quite comparable to Mr. Smith's computations if the free rate of 40 pesetas to the dollar were used. Twenty-five years has made very few changes in the Spanish citrus industry. From observations one may forecast that very few changes may be expected in the near future.

## CONCLUSIONS

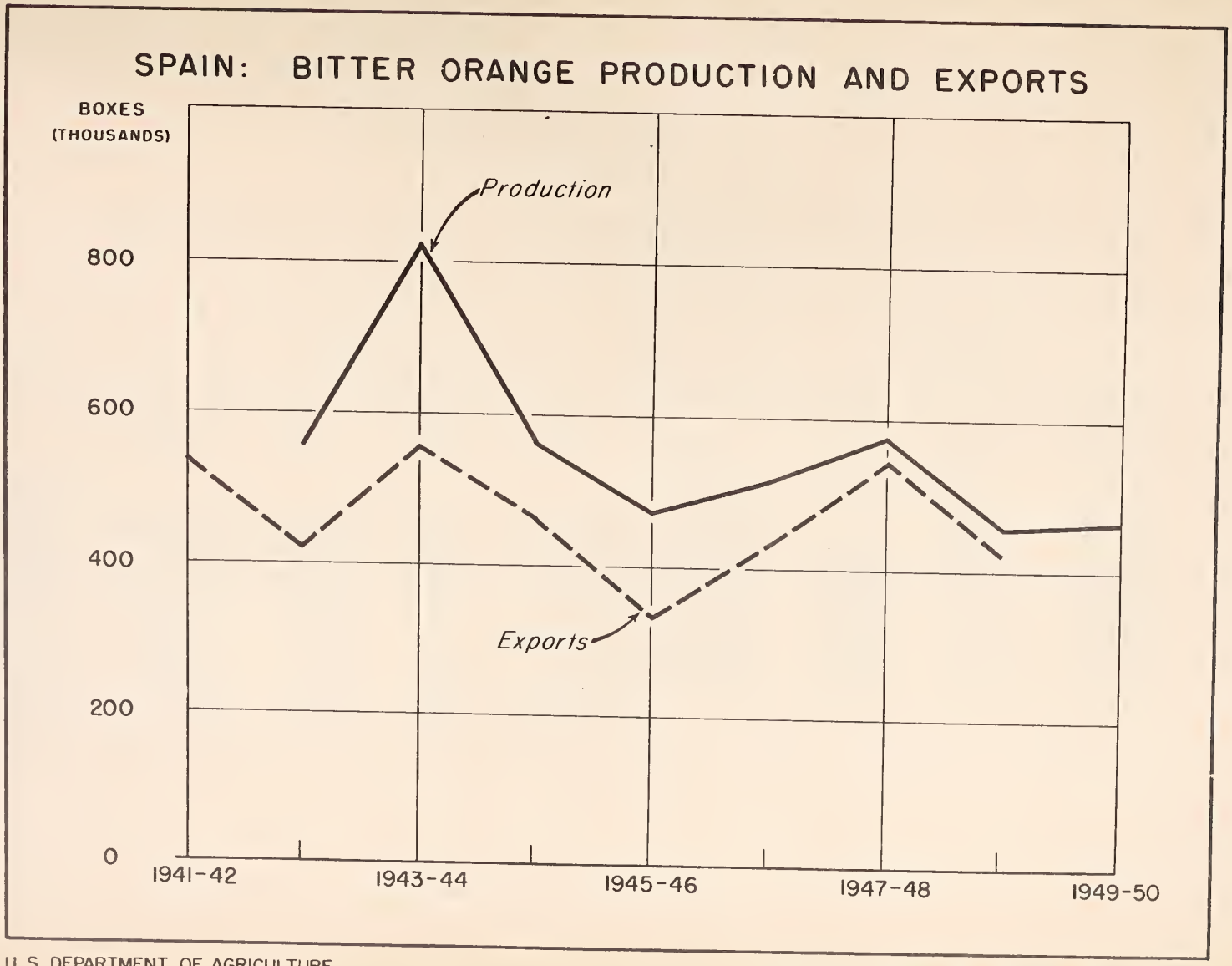
1. Due to reduction in acreage, other more profitable crops, and shortage of pest control materials and fertilizer, the production of citrus from Spanish orchards is not likely to exceed 750,000 tons (23,620,718 boxes) for the next 5 years.

2. No production above 750,000 tons (23,620,718 boxes) may be anticipated unless some major new plantings are made.

3. The large bulk of small Spanish processing plants will exist as long as Europe will buy citrus juice with sulphur dioxide added. At such time as the soft drink market will no longer absorb this product, the Spanish industry will have difficulty making an adjustment to produce a higher quality product.

4. The expansion of processing by modern units will not be a rapid one due to the lack of transportation to bring fruit to the processing plant and the shortage of power and the lack of foreign exchange to purchase equipment.

5. Spanish citrus industry will continue to be highly competitive in international fresh citrus markets.




U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Table 26.--Bitter oranges: Production and exports, specified areas, 1941-49.

| Season | Production | | | | Exports | | | |
|---|---|---|---|---|---|---|---|---|
| | Seville | Malaga | Algeciras | Total | Seville | Malaga | Algeciras | Total |
| | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes | Boxes |
| 1941-42 | | | | | 389,881 | 122,408 | 25,226 | 537,515 |
| 1942-43 | 431,315 | 103,931 | 20,786 | 556,032 | 406,097 | --- | 15,157 | 421,254 |
| 1943-44 | 692,874 | 103,931 | 25,983 | 822,788 | 495,181 | 37,535 | 25,841 | 558,557 |
| 1944-45 | 433,046 | 103,931 | 25,983 | 562,960 | 365,011 | 78,815 | 22,328 | 466,154 |
| 1945-46 | 346,437 | 112,592 | 17,322 | 476,351 | 304,726 | 22,655 | 6,981 | 334,362 |
| 1946-47 | 433,047 | 86,609 | --- | 519,656 | 372,420 | 43,304 | 17,321 | 433,045 |
| 1947-48 | 485,963 | 80,162 | 8,961 | 575,086 | 468,641 | 73,234 | 5,496 | 547,371 |
| 1948-49 | 405,331 | 45,903 | 6,063 | 457,297 | 371,121 | 45,903 | 6,062 | 423,086 |
| 1949-50 | 409,426 | 49,131 | 8,188 | 466,745 | | | | |

# THE SPANISH BITTER ORANGE INDUSTRY

The world's largest production of bitter oranges, which are used in the manufacture of marmalade and confections in the United Kingdom, are found in southern Spain. The major part of the plantings are in the vicinity of Seville. However, other scattered plantings are found in the vicinity of Malaga and Algeciras. This is not a large citrus industry, as will be noted by the attached table of acreage and production.

In the vicinity of Seville, orchards are scattered and occur primarily along the bank of the Guadalquivir River. Larger adjacent acreage may be planted to vegetables, grain, and corn.

## Production and exports

The production of bitter oranges has been declining since the season of 1943-44, as other crops in the bitter orange producing district have proved more profitable than oranges. The observed condition of the orchards would lead one to believe that this reduction in production may go on for some years to come.

The small consumption of bitter oranges in Spain is illustrated by the large percentage of production which is customarily shipped to Great Britain.

## Characteristics of Bitter Orange Districts

In the bitter orange orchards, trees are planted approximately 6 meters apart, which is a greater planting distance than the majority of sweet orange districts of Spain. As in other Spanish citrus plantings, this variety is budded in sour root stock. There is apparently a high degree of compatibility between the two stocks, since the usual bud-union deformity which occurs when sweet orange is budded on sour stock is absent in these groves. The trees are large, growing to sizes similar to that in California or Florida, and are commonly 6 to 8 meters tall. Most of the orchards seen consist of old trees, some planted as long as 60 years ago. In July, when the fruit was over and inch in diameter, the green fruit was easily seen, since the stem seems to hold the fruit out from the trees in quite a different manner from sweet varieties.

Few new plantings were seen. However, large areas in the vicinity of present plantings could apparently raise citrus if economic conditions would justify it.

## Cultural Practices

### Pruning

The pruning of the trees is similar to that observed in native orchards in Algeria and Tunisia. The lower limbs are removed, so that it is possible to cultivate with animals under and quite close to the tree trunks. In some groves the center of the trees are open as an inverted cone. However, this type of extensive pruning does not seem to be a general practice. In the groves visited,

the older trees were large enough to shade the entire row middle. Most growers seem to confine pruning to removing lower limbs, probably to aid cultivation, and to the cutting out of dead wood.

Cultivation

The orchards are cultivated by animal-drawn plows, with the small area surrounding the trunk cultivated by hand. In orchards visited borders for irrigation were also plowed. It does not seem to be a general practice to harrow or rake the ground after it is plowed, and the ground in groves was observed to be rather uneven. These orchards do not seem to be given the excellent care found in the southern sweet orange districts near Valencia. Weeds and grass were common.

Irrigation

In groves visited near Seville irrigation water was obtained from the river by pumping to the orchard level with an electric powered centrifugal pump. Some groves not adjacent to the river bank were seen to be wilting for lack of water. Water is applied by flood irrigation; two borders are placed down each row middle, and the water is permitted to flow down the rows, completely surrounding the tree trunks. In groves irrigated in this manner, a dry section is left between the two borders. By this practice irrigation water is applied somewhat opposite to the general practice in the vicinity of Valencia, where the water is kept away from the tree trunks by basins.

Water is applied at least three times a year. However, more frequent irrigation would seem to be necessary to keep most groves in satisfactory condition. Supplies of river water for irrigation are abundant.

Nursery Stock

As observed, most growers raise their own nursery stock and bud the trees quite high, usually approximately 2 feet from the ground. The trees are permitted to attain an age of 2 years before they are planted in the orchard. Due to the practice of high pruning, they are trained so that the framework crotch occurs about five feet from the ground. When a grower has a surplus of trees these are sold to others at a price of approximately 15 pesetas (95 cents) each.

Pest Control

Seville is a region of dry, hot climate, and red scale is a major pest. Infestations were observed in groves, and operators stated that control was obtained by fumigation, which was done usually every other year.

Mealy bug was observed, and the grove operator interviewed apparently did not know that crypt was available as a control measure from the Orange Experiment Station in the vicinity of Valencia.

Disease Control

Very little effort at disease control was observed. Due to the method of irrigation which permits water to come in contact with the tree trunk, fungus

and root diseases would seem to be encouraged. Frequent outbreaks of a bark eruption of gummosis were observed, and no control measures were noted. The Spanish farmers call this "Gumma," and they stated that at times a "special ointment" was applied to the diseased area. Diseased trees that are no longer productive are left in some orchards and generally the tree replacement program is rather haphazard.

Fertilization

Most of the groves give evidence of needing fertilizing. They have a small leaf population, and the trees are light green or in some places yellow. A healthy, dark, green-colored tree was the exception. It was possible to see through the trees in most groves.

## Marketing

Harvesting and Packing

Local labor harvests the crops. The fruit is picked from ladders by breaking the stem. On the ground in the orchard the fruit stem is clipped at the time of packing, and the packing operation is carried out in the grove. The fruit is wrapped, and the Spanish half case, which holds approximately 55 kilos (approximately 112 lbs.), is used.

At present, at least two packing operations are being set up in the city of Seville. They will be very simple operations, and their primary purpose is to furnish shelter, so that the packing may be done in wet weather. Until recently, the stems were not cut from the fruit, and considerable damage in shipment often occurred. The British Ministry of Food has been encouraging the clipped packing of fruit, and progress is being made in that little long stemmed fruit is now shipped. Since the Ministry of Food is practically the only purchaser, there is little marketing problem, and shipments are made in accordance with the British contract. During the shipping season, representatives of the Ministry of Food are in the citrus districts inspecting and directing shipments.

Some sweet orange varieties are to be found in the bitter orange groves. Some of these trees are over 50 years of age. They are primarily the Comuna variety, and are sold locally at a price of approximately 1.75 pesetas per kilo to the grower. The sweet orange retails at approximately 2½ to 3 pesetas a kilo.

Export Marketing

The export marketing situation for Spanish bitter oranges is excellently described in a report from the American Consul at Seville, Spain, written November 9, 1949, by Vice Consul Henry E. Dumas, assisted by clerk Luis Marquez.

The export situation could not be better described than by quoting from Mr. Dumas' report as follows:

Export Prices and Regulations

The basic point of the 1949-50 crop is the price to be agreed upon between the exporters and representatives of the British Embassy in Madrid, representing the Ministry of Food in London, which has not yet been established or given publicity; however, unconfirmed reports received in Seville in trade circles state that an initial price of 32/6d shillings ($4.55) for a half chest of 50-55 net kilos, f.o.b. has been agreed upon, applicable to shipments to Great Britain made before January 12, 1950, and 29-00 shillings ($4.06) for shipments made from that date to the end of the season. It is said that the Ministry for Industry and Commerce considered these prices low and ordered a revision with the tendency to increase them. Official unconfirmed prices, subject to change, already established for bitter oranges to be shipped to countries other than England are as follows:

Prices per half chest (50-55 kilos) f.o.b.

| Country of Destination | Foreign Currencies | Pesetas | Dollars |
|---|---|---|---|
| Sweden ..... | 29.00 crowns | 98.19 | $5.60 |
| Canada ..... | 5.45 dollars | 95.48 | 5.45 |
| Denmark ..... | 37.50 crowns | 95.10 | 5.42 |
| Netherlands ..... | 20.75 florins | 95.66 | 5.46 |
| Belgium ..... | 271.00 francs (Belgian) | 94.95 | 5.41 |
| Switzerland ..... | 23.50 francs (Swiss) | 95.11 | 5.42 |
| France ..... | 1,900.00 francs (French) | 95.09 | 5.42 |

The above prices are established in the currency of the country of destination. The equivalents, for purposes of comparison, have been calculated at 17.52 pesetas per $1.00, special exchange rate fixed by the Spanish Government for the exportation of bitter oranges.

These prices are given without date of shipment, and include a 5 percent discount for the foreign selling agent.

As in previous years, exporters of bitter oranges strongly complain that the present rate of exchange for conversion of pounds sterling into pesetas is inadequate and insist that if the rate is not modified the exporters will experience heavy losses. Actually the rate of 49.056 pesetas to 1 pound sterling is above the rate prevailing last season (44.13 ptas.), but is still considered inadequate by exporters. Exporters paid to growers of bitter oranges 28.30 pesetas ($1.62) for the fruit (half chest) during the 1947-48 crop, and 35.00 pesetas ($2.00) during the 1948-49 season; a little higher price may be fixed for the half chest for the 1949-50 season. Information obtained from the manager of a local orange grove reveals that the Sindicato Provincial de Frutos y Productos Horticolas, Seccion de Agrios in Seville, paid 15.80 pesetas ($0.90) during the 1946-47 season, 19.53 pesetas ($1.11) for 1947-48, and 20.00 pesetas ($1.14) for the 1948-49 season to small growers with deductions of transportation charges from the orange grove to the wharf and other expenses, amounting to approximately 20 percent, thus leaving to the grower a net income of 12.64 pesetas ($0.72), 15.63 pesetas ($0.89), and 16.00 pesetas ($0.91) for

the seasons, respectively.

As the above prices are considered very low it is stated that many bitter orange producers are contemplating the grafting of their trees to produce sweet oranges which obtain higher prices in the local markets, or otherwise to use the land for other more profitable cultivation such as cotton. With few exceptions, small growers of bitter oranges are not paying the necessary attention to their trees as regards fertilizers, irrigation, disinfection, and other cares.

While the production, cultivation, and sale of bitter oranges as well as disposition of the fruit in Spain are not subject to Government intervention, since the product is not rationed, the handling of the crop is entirely in the hands of the syndicate. Finally, exporters comment that unless they are granted a more favorable rate of exchange, or free disposition of the fifty percent of the foreign exchange received from their exports, a situation could arise which would make it imperative to abandon the fruit on the trees.

## Processing

In the Seville district is a very interesting citrus processing industry producing "orange flower water" and "petit grain". Petit grain is the distilled vapor which is given off by boiling green orange leaves and twigs. It is sold as a base for perfumes and some quantities are imported into the United States. Orange flower water is a medicine used in the treatment of nervous diseases, and it is obtained in the same manner as petit grain, by the condensation of the vapor given off by boiling orange blossoms. The plant observed by the author consists of a simple installation in an open field. In the case of petit grain the green twigs and leaves obtained by pruning were brought to the plant. The young oranges are removed, and the leaves and twigs are placed in a large caldron approximately 8 feet in diameter. A perforated sheet is placed over the leaves to hold them down, and a lid is placed on the vat in order to contain the vapors. The vapors are collected, carried to a still, and passed into a small container as the condensation process takes place. This raw material is filtered and, for some qualities, re-refined by other apparatus. When the boiling process is completed, the leaves are removed and placed beside the caldron, and when they are dry they are used as fuel to heat other batches. The leaves are brought from the orchard to the vat by two-wheeled carts, and we were told they are purchased at the plant by weight, at the rate of 30 centimos per kilo. We were also told that 500 kilos of leaves are necessary to produce 1 kilo of petit grain, which was said to sell for 180 pesetas per kilo. Petit grain is also produced from tangerine leaves.

Orange flower water is produced in exactly the same way, and the only processing done to the raw distilled product is filtering. As now operated, this is a very simple industry which produces two very unusual citrus by-products. The processing at Seville is done by manufacturers of various essences used in the manufacture of perfumes, medicines, confections, liquors, and so forth. The company processing these products was also producing essence from moss, anis oil, eucalyptus oil, and many other essences. The present crude plant for the citrus processes in use is to be replaced by a new large installation, where all of the

processes will be contained in a modern building and a much larger volume of production obtained. There will probably be only a limited amount of this production, but it is an essential part of the industry as it exists today. No other processed products have been manufactured in the vicinity of Seville since the Civil War. At one time marmalades and confections were manufactured but this has been discontinued.

Dried Orange Peels

According to the reports of the American Consulate at Seville, bitter orange pulp is prepared at Seville, whenever the orange crop is not entirely purchased and disposed of through fresh fruit channels.

At Malaga bitter oranges which cannot be shipped as fresh fruit are prepared for market by drying the peel. In 1944 approximately 300 metric tons of dried orange peels were produced at Malaga.

The normal markets for this dried product are Sweden, the Netherlands, Belgium, Germany, and Switzerland.

APPENDIX

## SPANISH GOVERNMENT RELEASES NEW REGULATIONS COVERING ORANGE EXPORT SEASON OF 1940-41

In anticipation of the inauguration of the orange export season for Spain for the 1940-41 period, the Ministry of Industry and Commerce has issued an Executive Order dated November 28, 1940, which embraces a number of new regulations. This Executive Order was promulgated in the Boletin Oficial del Estado on November 30, 1940.

The new regulations become the responsibility of the National Orange Syndicate. Only two grades of oranges are recognized for export, those which are to be known as "selects" and "extra selects." The new regulations also include directions as to the utilization of trade names, the means through which sales can be effected, i.e., either direct to foreign importers or through an established sales agent, and provide as well for the strict observance by all exporters of values and prices which have been established by the Ministry of Industry and Commerce through recommendations received from the National Orange Syndicate.

An outline translation of the Executive Order dated November 28, 1940, follows:

Article 1.

The exportation of oranges shall be carried out exclusively by cooperatives, producing exporters, and exporters.

Article 2.

Oranges intended for the export trade shall be only of first quality and must meet the following minimum requirements:

Fruit of the same variety, even though there may be some irregularity in coloration, or may be slightly deformed and the skin slightly corrugated, must be of firm texture; must be free from any skin blemishes such as those caused by the sun or by the extraction of essential oils, free from decay or splits acquired during the growing period; must not present scars of interior dryness; must be free of "poll-roig", "poll negre", "serpeta" and other injurious insects; must not show signs or indications of cryptogamous infection, such as the "negrilla" or anything similar; must not show damage from fly attack or damage produced from washing machines. The navel variety will be placed in this category, if there are excessive deformities or large bud marks.

This class shall be known as "selects".

Article 3.

Without prejudice to the minimum requirements established for the first class of oranges, a further special classification is created, the characteristics of

the oranges falling under this heading being as follows:

Must be fruit of the same uniform variety and coloration, firm, of good form and fine skin. The fruit must be free from cuts, discolorations produced by the sun, or from any blemishes indicating the extraction of essential oils, free of splits or decay acquired during the growing period; shall have no scars which may presume the inferiority of the fruit pulp; must be free from damage caused by either spraying or fumigating; must not show signs of interior dryness; must be free of "poll-roig", "poll-negre", "serpeta", and other insect damage; must not show evidences of cryptogamous infection such as the "negrilla"; must not show fly damage or damage from the washing machines. Navels may not be included in this class when the "bud" mark is excessive.

This class shall be known as "extra selects".

Article 4.

The use of the classifications established previously shall be obligatory, each box to carry a statement or indication of the grade of fruit it contains. For bulk shipments, the individual paper wrappers must show the grade, and in those cases where such wrappers are not employed, the grade must be specified either on the railway or steamship bill of lading.

Article 5.

The sale of fruit from producers to merchants shall be free of restrictions. The National Orange Syndicate shall make public information as to any global sales or commercial agreements concluded with foreign countries so that the values received for such sales may serve as general information to producers and exporters.

Article 6.

The cases to be used for exports must meet the requirements outlined in the Decree of the Presidency of the Council of Ministers dated October 13, 1934, although in addition the utilization of a box containing 26 kilos net weight of fruit will also be allowed.

No name or mark may be used for export unless it has been approved by the Syndicate and set down in its register, the number of such marks which may be used by individual exporters to be limited by the Syndicate. It is prohibited to include as part of a mark or name a designation of a place other than that locality from which the fruit has been gathered and by the same token an exporter may use a mark only if it is his property.

Article 7.

Shipments are to be made only by persons so engaged in this business. In the case of consignments the regulations regarding shipments may, when necessary, be controlled by the National Orange Syndicate, taking into consideration such elements as the market prospects, stocks held by the Cooperatives, and the quantity of exports not only during the three year period 1933 through 1936 but also during the season 1939-1940.

Article 8.

The Ministry of Industry and Commerce will issue all export licenses in accordance with legislation now in force; applications may be made through the National Orange Syndicate.

Article 9.

No shipment or a part of shipment may be loaded without its having been inspected by the so-called S.O.I.V.R.E. (Servicio Oficial de Investigacion, Vigilancia, Regulacion y Exportacion) in accordance with standing legislation. This inspection service shall also be performed in warehouses so as to insure the full observance of all regulations.

Article 10.

The Ministry of Industry and Commerce shall control all problems of participation in shipments, when these exist, inquiries to be made through the National Orange Syndicate.

Article 11.

Exporters shall make sales to importers direct, or through sales agents, the latter to receive the usual commission in each market, these commission payments to be approved by the National Orange Syndicate, the commissions to be deducted from the corresponding bill or invoice.

In those sales direct to importers which do not involve a sales agent no allowance whatsoever may be made for a commission payment.

In making "firm" sales no prices may be quoted which are lower than those set by the Ministry of Industry and Commerce as a result of previous advice from the National Orange Syndicate as regards varieties, qualities, and market conditions.

All "firm" sales, when possible, must be made for cash.

Article 12.

Private sales shall also be free of restrictions although the Ministry of Industry and Commerce reserves the right to prohibit such transactions for export, and may impose fines, if prices involved in such sales are unjustifiably lower than those obtained under other circumstances and for the same quality fruit.

Article 13.

All exporters, within a period of 48 hours after the shipment of fruit, must deliver to the National Orange Syndicate copies of all shipping documents. Banks involved in such shipments must report any refunds of financing to the Syndicate. When the financial records of the banks do not agree with the corresponding export licenses, the Syndicate may fine the exporter, or even prohibit further shipments,

provided no adequate explanation of the differences is offered.

Article 14.

The Ministry of Industry and Commerce shall also issue regulations covering the domestic marketing of oranges when this is necessary.

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Source: Transmitted and translated by the American Embassy at Madrid. Report #181.

## OFFICIAL SERVICE OF INSPECTION, SUPERVISION, AND REGULATION OF EXPORTATIONS

The Decree of Aug. 21, 1934 created the Service mentioned.

By Decree of Oct. 4, 1935 (Gaceta of the 6th, under Ministry of Agriculture, Industry, and Commerce) the functions of this Service are regulated so far as they relate to inspection, an extract from the same being given below.

### CHAPTER I

### REQUIREMENTS AND GENERAL CONDITIONS FOR EXPORTATION

Art. 1. An indispensable requirement for engaging in the exportation of oranges and other citrus fruits to foreign markets shall be the prior registration of every individual, commercial firm, joint stock company, or fruit cooperative which proposes to engage in this business, in the Official Register kept for this purpose in the Production and Exportation Section of the General Bureau of Commerce, in accordance with the Order of October 8, 1932.

Art. 2. The number obtained by each exporter, after his registration in the Official Register of Exportation, shall be stamped on the packages or outer containers of the shipments intended for abroad, in a perfectly visible spot, and in dimensions no less than three centimeters in height. Exporters in bulk who wrap the fruits in tissue paper shall stamp their Registry number on this wrapper. Exporters who ship the fruit in bulk, without tissue paper wrapper, shall stamp the Exporter's Registry number on the invoice sheets and sales invoices.

Art. 3. Exportation of oranges and mandarins which do not show sufficient commercial maturity will not be permitted. For this purpose, oranges are considered ripe when the rind shows no green color, and their internal maturity is such that they do not contain an excessive degree of acidity.

By exception, the mandarins shall have greater tolerance with respect to coloration, provided their size is not less than 50 millimeters in diameter, and

the degree of internal maturity is considered commercial, the exterior being required to have a minimum of 50 percent of yellow or yellowish-red color.

Art. 4. Scientific or forced coloration will be permitted only for those oranges which, after undergoing this treatment, show a corresponding degree of external and internal maturity.

For this purpose, coloration may be applied only to the varieties known as"Washington navel", "Cadenera", "Clementine", "common Mandarin", and "Satsuma", provided their internal condition of maturity is perfect. However, the "Clementine" and "Satsuma" varieties may be colored scientifically only after October 25, the "common Mandarin" after November 5, and the "Washington navel" and "Cadenera" after November 10.

Art. 5. No lot of oranges may be exported which, at the time of inspection, does not have a density of juice above 1,052.4. In any doubtful cases which may appear in the determination of this density, the limit of 21 degrees of citric acid per liter of juice shall serve as a maximum.

Art. 6. Exporters who have equipment for the coloration of oranges shall be obliged to register, before the coloration chamber begins to operate, in a Register which shall be kept for the purpose in the offices of the Official Inspection Service, in which shall be recorded the location of the chamber, its specification, capacity, etc. Immediately thereafter, and as a prior requisite before the coloration chamber can begin to operate, the Engineer of the Official Service shall make a visit to the site of the chamber to inspect its installation, and if this is satisfactory, he shall issue the proper certificate authorizing its operation. If the Engineer who makes the inspection deems it necessary, he may ask for the assistance of an expert on coloring gases who is known to be a gas fitter, the costs occasioned by the inspection of the installation being for the account of the owner of the chamber in any case.

Exporters who have equipment for scientific or forced coloration of citrus fruits shall be obliged to keep a registry book in which are recorded the day, and use made of the coloration chamber, with a detailed statement of the quantities subjected to the process, their classification, etc.

The members of the Official Service and Inspecting Boards of the locality shall make frequent visits of inspection to observe the operation of the coloration chambers, checking whether fruit is colored which does not meet the prescribed conditions of internal commercial maturity, and investigating, if occasion arises, the existence of those which operate secretly.

Art. 7. The installation of coloration chambers for purposes of industrial exploitation is peremptorily prohibited, the use of each installation being permitted only to the rightful owner of the same, to process the fruits which are to be exported in his name.

Art. 8. Violation of any of the above provisions on coloration shall be punished with fines of from 500 to 5,000 pesetas, and in case of repetition of the offense, and without prejudice to the fine which may be applicable, the

chamber shall be attached and the equipment sealed for the remainder of the export season.

Art. 9. The lemons and grapefruit for exportation shall present the coloration normal for the varieties to which they belong, in a state of commercial maturity, and the acidity of maturity normal for each variety.

The green lemons from Malaga, Murcia, and Valencia, of varieties other than the so-called "Viernie," shall continue to be exported in the accustomed form, quality, and conditions.

Art. 10. The fruit shall be prepared or shipped after cleaning, airing, and grading in the packing houses. Damaged fruit shall be eliminated, together with that which shows abrasions, long deep scratches, or lesions of a serious character, and that infected with pests, such as "red louse," "negro," scale insects, "negrilla," or other parasites.

Art. 11. Oranges of a size smaller than those called "504," in a half-box, shall not be exported.

Oranges exported in boxes, size of which is the so-called "504," in half boxes, as well as those exported in bulk, of a size of 55 millimeters in diameter, may be exported only in the amount of 15 percent per shipment.

The National Orange Board is authorized to vary these proportions when such action is justified by the firm and verified orders of the receivers of the merchandise. Independently of all this, the National Orange Board is charged with the duty of making a detailed study by country during the coming season, of the absorption capacity and characteristics of each market in relation to sizes, in order to determine for the future the percentages of small-sized fruit suited to the tastes and characteristics of each consuming market.

Art. 12. The fruits contained in each package shall be of uniform quality, size, and maturity, with the single tolerance, for size, of up to three millimeters above and below the average diameter of the fruit for the contents of each box.

Shipments of unpackaged fruits in bulk may be made, containing either fruits selected by size, or various sizes mixed, provided specification is made on the shipments that they are by weight.

Shipments of packaged fruits in bulk may be made, either of fruits selected by sizes, or mixed sizes, provided the sizes and gross weight of the merchandise are indicated on the packages.

## CHAPTER II

Art. 13. To ensure compliance with the above requirements, all shipments of citrus fruits (oranges, mandarins, grapefruit, and lemons), destined for abroad, remain subject to prior inspection by the State, which shall be performed hereafter as an indispensable step toward their shipment, according to the standards established by the present Decree.

This inspection shall be rigorous throughout the entire season, especially at the beginning of the campaign and when frosts occur.

The Custom Houses through which the merchandise is sent shall authorize despatch of only those lots which are accompanied by an inspection certificate issued by the Official Inspection Service established in each port or station, or by the Inspection Boards especially qualified for this purpose, established at the stations of origin. In the latter case the certificate in question shall be visaed by the Official Inspection Service established in the ports or stations of exit.

The service of prior inspection for shipments of citrus fruits shall be established at the ports and stations of origin. It shall remain, nevertheless, a control inspection on the frontiers to supervise the work of the various Inspecting Boards which operate at the stations of origin and shall exact, when needed, the responsibilities for which there is occasion.

If a technical inspection is to be made, distinct from the commercial, it shall necessarily have to be made at the same time. For this purpose, the experts who are to make this inspection must be present at the time the commercial inspection is made, so that they can perform their mission.

Source: La Riqueza Citricola Espanola (The Citrus Wealth of Spain), Madrid, 1949 by Luis Roson Perez. Appendix No. 12, pp. 293-296.